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DECEMBER 1961

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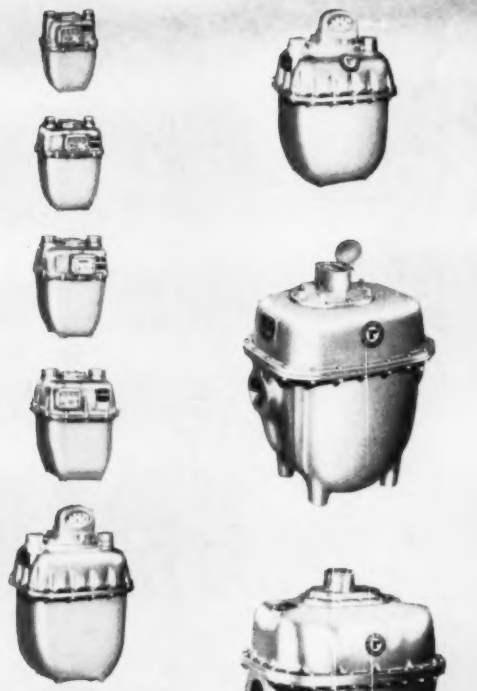

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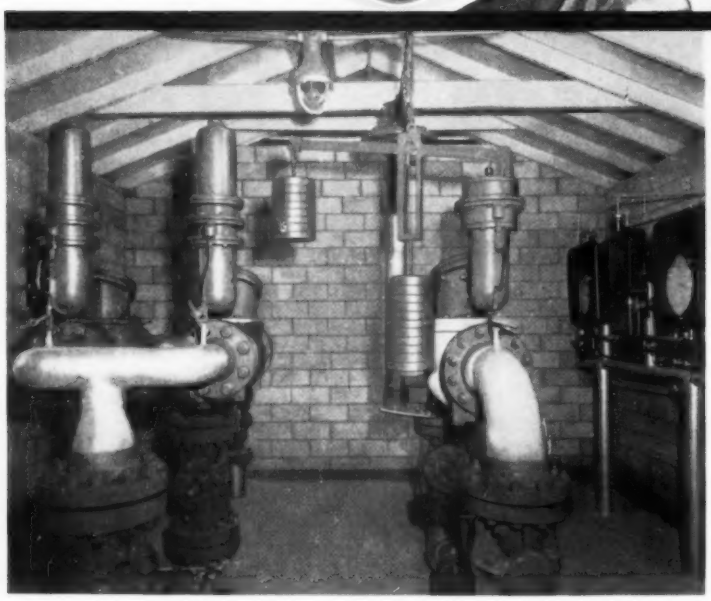

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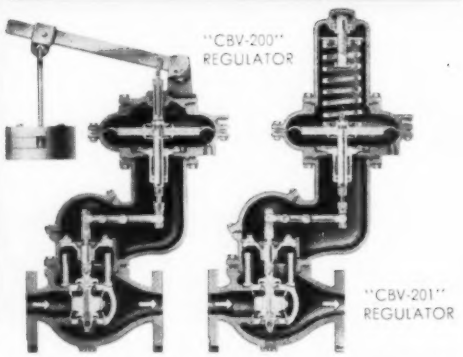

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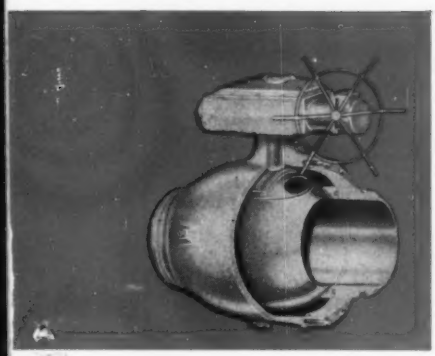

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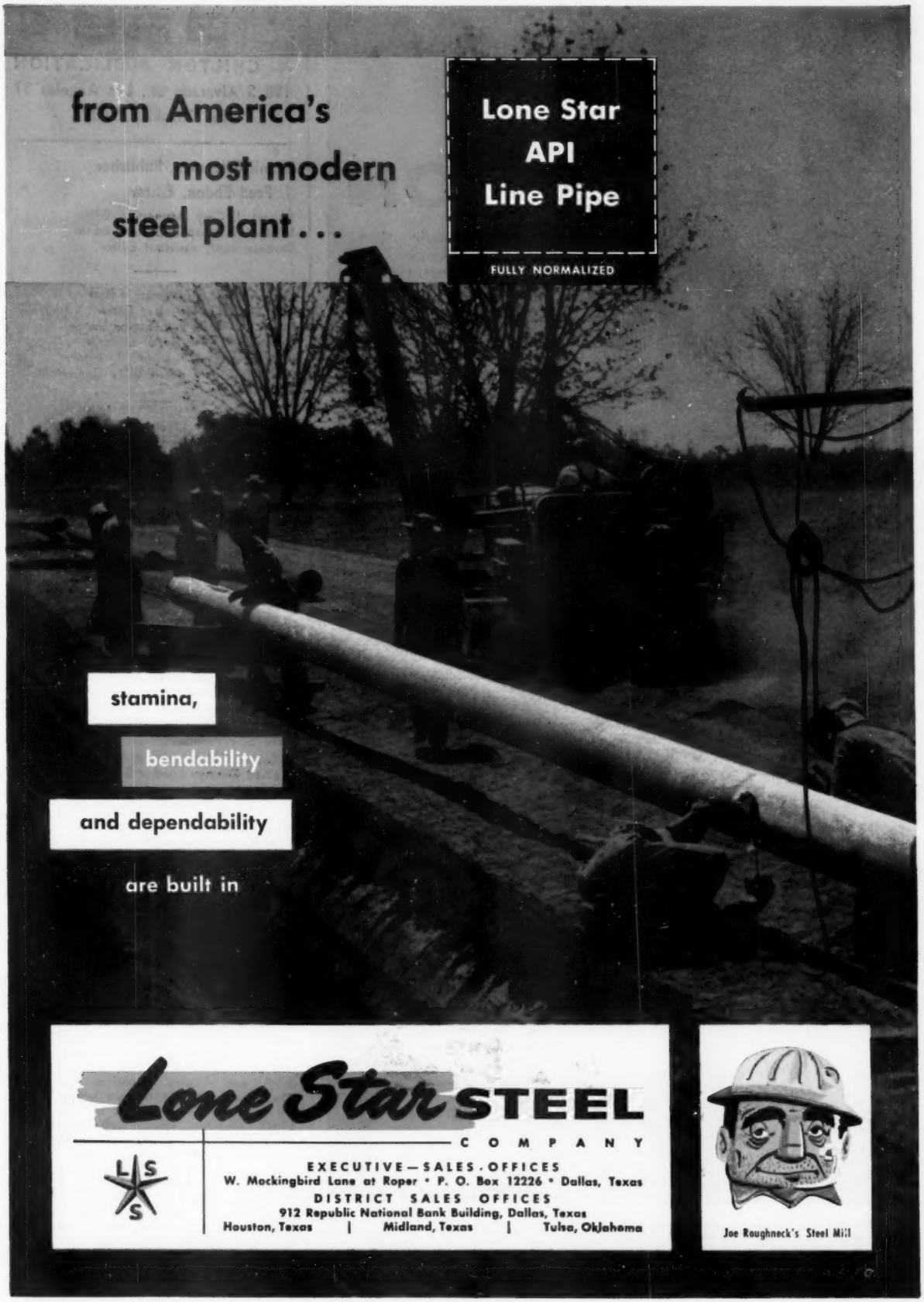
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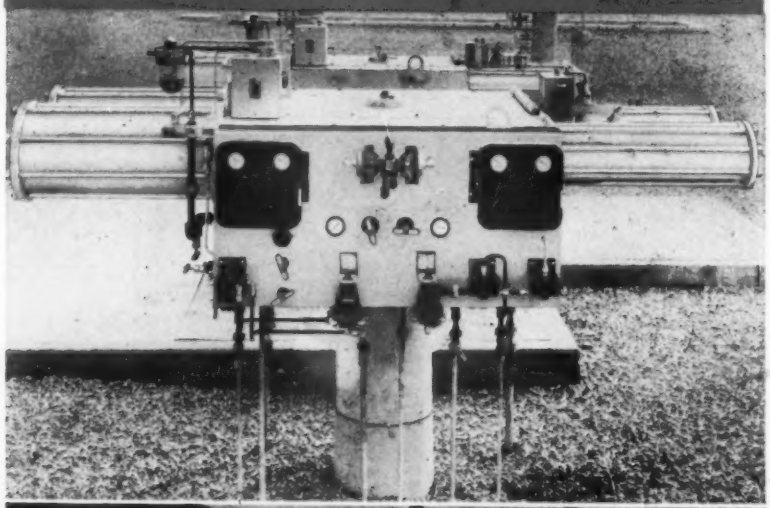

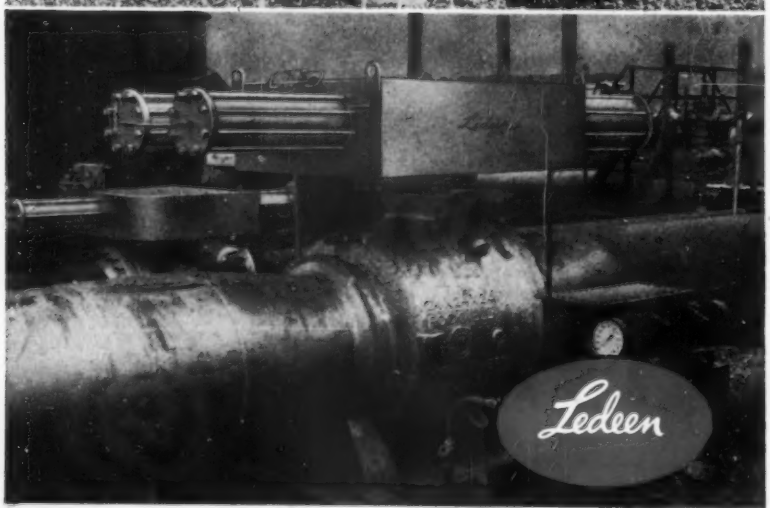

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CALENDAR

December

4-5..Florida Natural Gas Association Annual Sales Conference—Sarasota, Fla.

1962

February

14-16..AGA Home Service Workshop—Milwaukee Inn, Milwaukee.

March

18-22..National Association of Corrosion Engineers—Municipal Auditorium, Kansas City, Mo.

22-23..New England Gas Association Annual Meeting—Statler Hilton, Boston.

26-28..AGA General Management Section Annual Conference—Denver Hilton Hotel, Denver.

April

2-5..AGA Operating Section Distribution Conference—San Francisco.

9-10..Mid-West Gas Association Annual Meeting—Hotel Radisson, Minneapolis.

10-12..AGA Sales Conference on Industrial & Commercial Gas—Shoreham Hotel, Washington, D. C.

17-19..Southwestern Gas Measurement Short Course—University of Oklahoma, North Campus, Norman.

23-25..GAMA Annual Meeting—The Greenbrier, White Sulphur Springs, W. Va.

30-May 2..Joint AGA Transmission Conference and Southern Gas Association Annual Convention—Houston.

May

21-23..AGA Mid-West Regional Gas Sales Conference—Edgewater Beach Hotel, Chicago.

25-26..Florida Natural Gas Association Annual Convention—Robert Meyer Hotel, Jacksonville, Fla.

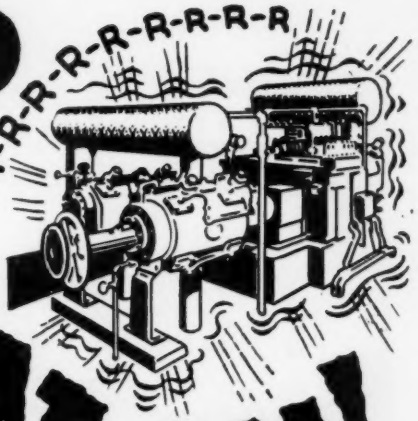
June

4-5..AGA Operation Section Production Conference—Statler Hilton Hotel, Boston.

20-23..Canadian Gas Association Annual Meeting—Manoir Richelieu, Murray Bay, Quebec, Canada.

25-26..Michigan Gas Association Annual Meeting—Grand Hotel, Mackinac Island, Mich.

STOP R-R-R-R-R-R-R-R-R-R



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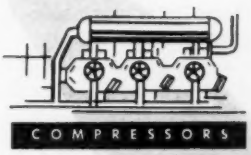

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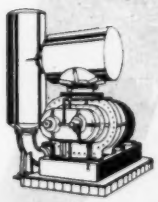

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Thermally Thinking

DECEMBER 1961

Needed: A republic of wills

IT is thrilling to know that IGT is delving into the effect of ceria-thoria catalysts on combustion of methane. I might point out to Henry R. Linden, the very able new director of that vital gas-industry resource, the thought that if he is looking for really large-scale combustion to study, we can supply it on occasion here in Conflagration Corners, Calif. An advantage would be that Dr. Linden would not be limited in any way to combustion at the burner. He could research away as the complete appliance, the house itself, and significant areas of surrounding geography are consumed.

While following our most recent home-burning fire ritual and wild animal barbecue, which even we non-arson inclined do, we found time to hustle through several periodicals. These were publications that assert to provide current expert analysis of business, financial, and political climates.

Among reports of business' optimistic gloom, labor victories, who's in jail from industry, and the latest list of anti-trust suits, was quieting news. It seems the Administration is worried about an "anti-business image." Articles made it plain that Washington is too concerned about this nation's commercial and industrial communities. Chimerically, it seems, we had previously read our Administration as a bit anti-private-industry.

The Hon. Joseph C. Swidler, for example, is reflecting this change. He said some thoughtful things at INGAA. His championing of the area gas price concept (produced by the "old" commission) is one first step away from past failure. We trust, Mr. Chairman, that the words in your address and during the press conference were not mere parts of the image rebuilding.

There is some question in my mind that the "new" FPC commissioners will be able to untangle federal regulation of the natural gas business under a Natural Gas Act which has failed to provide guide lines and applicable standards. The Act, to me, is the core of the problem and has needed Congressional repair for some time. But I will say that the current commissioners are, bless their hearts, working and working hard to find paths through the regulatory thicket.

Setting aside the negative, let's assume fair and fast regulatory action can be hammered out without Congress applying legislative patches on the Act. To do this, Mr. Swidler and company will need all the ideas, thoughts, and cooperation obtainable from each segment of the gas industry. He has called for this. He deserves gas industry help, for the Federal Power Commission cannot do the job alone.

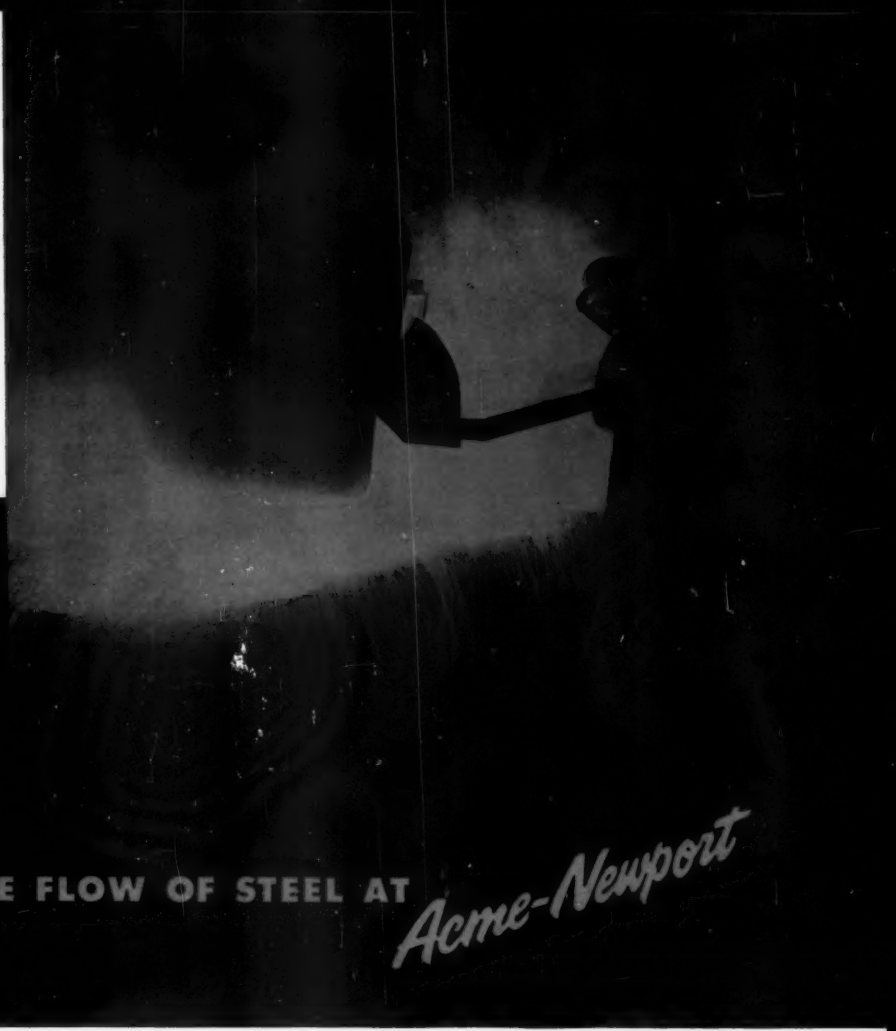
Although our industry has been engaged in a card game in which the other fellow (FPC, courts, and government) not only holds most of the trumps but is able to rewrite the rule book to fit immediate conditions, the gas business has done rather well. During the past few years we have felt the power of the Supreme Court from the impact of gas producer regulation. Presidential vetoes have been experienced. Expansion delays have become quite common, even expected. Congress threw a wildly-swung blow via a committee hearing into the industry's relationship with FPC—an action that rather fell on its face. And we have always been plagued by similar artificially created impedances. Yet, the underlying strength and intelligent, experienced management of gas companies have produced astounding progress. The industry will continue to make good progress.

As 1962 approaches, then, may I draw the attention of both government and gas people to the words of Immanual Kant. This German philosopher of 200 or so years ago wrote: "Rosseau has this idea, that man should work for mutual enlightenment. From this time on, the dwelling place of virtue no longer lies in individual perfection, but in the just relations of men to each other. What is to be fashioned is a republic of wills."

I don't think Kant meant hard-headed determination by his use of "will." Rather, he implied a spirit of confidence, understanding, and friendship, based on the idea of a shared approach to the business at hand and needs of the future.

J. Ford Eheban

EDITOR



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	.237″	10.79
6⅝	.156″	10.78
	.188″	12.89
	.219″	14.97
	.250″	17.02
	.280″	18.97

GAS HIGHLIGHTS

Intrastate gas mixed when mixed

Gas destined intrastate, but commingled with interstate gas, and nonresale gas crossing any state line, is subject to FPC jurisdiction. This was FPC's opinion in rejecting contentions by two companies that sales to El Paso Natural Gas were nonjurisdictional. LoVaca Gathering Co. proposes to sell gas in Texas to EPNG for company use only, but in several states. No resale is involved according to the contract. Houston Pipeline Co. proposes to sell gas in Texas to El Paso for company use only, the gas to remain in Texas by contract. While not passing on the authorizations or rates, FPC did rule both sales jurisdictional. The commission said the touchstone to the question whether a sale of gas is for resale in interstate commerce is what is done with the gas, not what the parties may say about the transaction, verbally or in writing. FPC said EPNG could not physically restrict gas from either purchase strictly to company use either inside or outside of Texas after it was mixed with interstate gas in the company's vast integrated system.

Disenchanted little Enumclaw

Another municipal gas system is in trouble. After less than four years of operation, the municipal gas system in Enumclaw, Wash., is in the red and has serious financial trouble. Some civic leaders among the 3269 population have the opinion that unless the situation can be improved fast, the city should get out of the gas business.

New type of contract by PLGS

More than 87 per cent of California-produced gas to be purchased by Pacific Lighting Gas Supply Co. (Los Angeles) in 1962 is covered by new type long-term contracts which run from a basic period of 20 years upward beyond 35 years. The new contracts are designed to provide a long-term ceiling on prices for gas the company purchases in southern California. And they are capable of reducing prices for California gas at some time in the future, the company stated.

TGT files a big one with FPC

Tennessee Gas Transmission Co. (Houston) has filed with FPC for approval of a $56.6 million expansion of its south-Texas-to-New-England gas pipeline system. It proposes to hike design delivery capacity of its systems to over 2.9 billion cu ft per day. Customers of TGT and Midwestern Gas Transmission Co., a wholly owned subsidiary, would get additional gas for the 1962-63 winter and thereafter. The filing amends an earlier application and proposes construction of 210 miles of large-diameter pipeline along with 87,700 additional compressor hp. Supporting the application is data showing 18.8 trillion cu ft of natural gas reserves dedicated to the TGT system, including 6.4 trillion of newly submitted reserves. Reserve life index of the supply is 19.7 years from Jan. 1, 1962.

Commission brings down southern Louisiana ceilings

FPC has reduced ceiling prices for new sales of natural gas in onshore and offshore southern Louisiana by 2 cents/Mcf. The new price ceiling is 21.25 cents/Mcf, including state taxes, for new sales onshore in southern Louisiana. Offshore, where state taxes do not apply, the new sales ceiling is 19.5 cents/Mcf. (Louisiana tax is 2.3 cents/Mcf.) FPC has generally used a total ceiling price of 23.25 cents/Mcf for both on and offshore initial sales in the area. The commission feels the 1.75-cent differential (actually 0.55 cents after taxes) between new onshore and offshore sales prices is additional incentive enough to get gas producers out in the water. The prices are interim until area hearings are concluded.

San Francisco to greet Canadian gas

Probably during the first five days of this month, or at the latest by Jan. 1, Canadian natural gas produced in Alberta will flow into the PG&E distribution system at a point near San Francisco.

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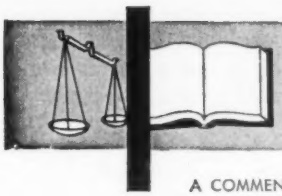


Regulatory and Legislative Trends

A COMMENTARY ON NATIONAL AND STATE DEVELOPMENTS BY AN EXPERT IN UTILITY LAW

The future for gas supply and prices

INTENSE interest is being shown in the future of natural gas supply and prices by customers, gas companies, investors, regulatory agencies, and legislators. Natural gas is a big business. The natural gas reserve life index is about 20 years and the 1960 net production was more than 13 trillion cu ft. If the price of the volume of natural gas marketed in 1960 were increased only 1 cent per Mcf, the customers would have to pay $127 million more for the gas.

There are expert opinions that the ultimate natural gas reserves in the United States will range between 1200 to 1700 trillion cu ft. The incentive to discover and produce natural gas is recognized as a prerequisite to the adequacy of future supply. One expert estimates that FPC controls plus the prices of competitive coal and oil will restrict gas prices to an increase of about 1 cent per Mcf each five-year period in the future. New FPC Chairman Swidler has publicly approved the commission's effort to fix natural gas producers' prices by areas. He made it plain that area prices must be ceilings and not floors. However, he added that he would not delude himself that simply recovering costs plus a 6 per cent return on investment is sufficient incentive for discovering ample gas. The outgoing president of the American Gas Association, L. T. Potter, favors the area pricing approach for the regulation of producer rates. Mr. Potter called it a "masterful effort to establish something workable in the regulation of field prices for gas." The fixing of a price for each gas producing area is intended to replace the case-by-case utility cost rate base concept in producer regulation.

• A 20-year forecast

In a recent major natural gas pipeline certificate case, Dr. B. C. Netschert, who has degrees in geology and economics, looked ahead 20 years and gave this encouraging opinion:

"I assume first that because of the effect of demand elasticity, a slower growth rate, and the trend of public regulation, the future price of natural gas in the United States is more likely to be cost-determined than demand-determined, as it was in the past.

"In considering costs over time it is necessary to distinguish between the inflationary element and the resource, or real element. The specific degree of future inflation cannot be projected, since it depends to such a large extent on government policy, which cannot be treated statistically. Although inflation may continue over the next decades, it is by no means a certainty or an inevitability.

"The resource, or real cost element is measured by drilling and equipping costs. These depend on the basic natural abundance of gas and the technology with which it can be found and produced. There is good evidence for and a considerable body of opinion with the belief that natural gas is, in fact, still abundant. At the same time, the past and current record of technological progress in the discovery and production of gas indicates that this progress will continue in the future.

"Nevertheless, there will be upward pressure on costs from the resource side because of the increased importance of depth in the discovery and production of gas. Yet technology to date has been able to cope with this effect, and its currently growing importance is being matched by such significant technological advances as fracturing, multiple completions, greater penetration rates and improved drilling techniques. The greater value of gas-condensate over dry gas reservoirs will also contribute to off-setting the tendency for real cost to rise with depth, as will improved and more widespread adoption of conservation measures.

"An analysis of real costs over the past decade as measured by industry statistics shows that there has been only a moderate increase—at the most, a general rate of 0.84 per cent per year. This record plus the fact that the industry is only beginning to reap the full benefits of our accelerating technological progress in general provide good grounds for optimism concerning the future of gas supply and costs.

* * *

"I conclude on the basis of the foregoing that a rise in the real cost of natural gas in this country over the next 20 years is not inevitable, and that a 25 per cent rise is a highly unlikely eventuality."

• The cause of postwar rise in gas prices

Dr. Netschert considers the rise in gas prices since World War II to have been demand-induced. In part this is illustrated by the circumstances at the close of World War II. A relatively small portion of the large national gas reserves was connected to markets. The postwar pipeline construction boom transformed the latent demand for gas into an effective demand in the field as pipeline companies acquired reserves. Prices rose in the face of this increased demand. Each new

pipeline has created an additional effective demand in the field, and so the demand pressure on price has continued. Effective demand has exceeded effective supply, in the sense that there has remained unsatisfied demand at the existing price, throughout the postwar period. Indeed, here is the demand-induced price rise.

• The future price of gas

Of the two ways to forecast future gas prices, Dr. Netschert discards the repetition of past experience. There are two ways of considering the course of future gas prices. First, one could assume that the future price will rise on the same basis as in the past: that it will be demand-induced. At the annual rate of increase in gas prices in the postwar period to date, this would result in extreme prices in the next 10 to 20 years. Several constraints would make such results unlikely. Two of these restrictions are interfuel competition and the elasticity of segments of the demand for gas. Wherever the application is essentially a matter of Btu content, as in boiler-fuel use, natural gas is in direct competition with coal and oil, and in general it will not sell at the point of consumption for more per Btu than the other fuels. In these uses, then, the Btu price of the competing fuels is a ceiling for the Btu price of natural gas. The resulting response in the effective demand for natural gas is the elasticity of that demand.

There is another element of demand elasticity, that of the new consumer. The householder who is not yet connected to a gas main has a choice of the heating and other service he will use, and that choice is influenced by the price of the various energy commodities. The consumer already tied-in to gas service does not, of course, have this option until the time of replacement of his equipment.

Another constraint on future demand-induced price increases stems from the slower growth in future demand for natural gas that can be expected. Past utilization statistics reveal that the growth in natural gas consumption was composed of two elements: (a) The opening up of new geographical markets to long-distance pipeline construction, and (b) the conversion to natural gas in uses previously the market of other fuels, such as the conversion of space heating from coal or oil to gas. Development has already proceeded so far that there is little room left within which past experience can be repeated. Virtually the entire country is now a market for natural gas, and there are no more easy victories left for gas in interfuel competition — victories which were in some part due to a substantial price advantage in favor of natural gas.

There is still plenty of room for continued growth in gas demand. Expansion is expected in existing markets through population growth and increased use per customer. By their nature, however, these growth elements cannot yield the large annual increments to consumption experienced through the addition of wholly new markets.

Natural gas prices are under regulation at both the point of production and point of consumption by federal and state regulatory agencies. These agencies will endeavor to meet their public responsibilities to the best of their abilities, and the greater the degree and duration of future price rises, the more difficult it will be to win rate approval.

The second approach is that the future will *not* be the same as the past, in that future gas prices will be cost-determined, rather than market-demand determined. The recent and current indications are that the Federal Power Commission will give greater weight to changes in the general level of costs within the natural gas industry as an element in fixing prices. Changes in the price of gas will bear a much closer relation to changes in the cost of gas in the future than in the past. This being so, the subject for analysis becomes costs rather than prices.

In considering costs, over time, one must distinguish two elements: (a) the inflation element, reflecting the decline in the purchasing power of the dollar, and (b) what may be termed the "resource" element, reflecting the difficulty of finding and producing gas; its real cost.

Dr. Netschert made no conclusion about future inflation saying:

"One of the important determinants of inflation is governmental policy decisions. These cannot be dealt with or projected statistically, and if one wants to make the assumption that governmental policies in the next 20 years will contribute to inflation, I point out the equally plausible assumption that prevailing government policy over the coming 20 years may well be one of active counter-measures to inflation, despite the fact that this has not occurred in the recent past and is not now the prevailing policy."

A significant measure of the cost of finding and producing gas, testified Dr. Netschert, is provided by the tangible and intangible expenses in the drilling and equipping of wells. It can be demonstrated that when these prices are deflated —that is, when the inflation element is removed—they reveal that the real cost of gas at the wellhead has undergone at most a modest increase in the postwar period.

The real cost of gas depends on two things: the abundance of gas as it exists in nature, and the technical ability of the industry to find and produce that gas.

For a long time the discovery of gas was largely a by-product of the search for oil. In recent years this has changed. It is now becoming apparent that the occurrence of gas not associated with oil is a much more common phenomenon than formerly thought. To the extent that the search has turned to non-associated gas, the ratios that can be derived from the results of that search become less applicable. In addition—and this is an important concomitant—to the extent that the search for non-associated gas becomes a greater part of the total exploratory effort, the future supply of gas is less tied to the effort devoted to oil search and the degree of success in that effort.

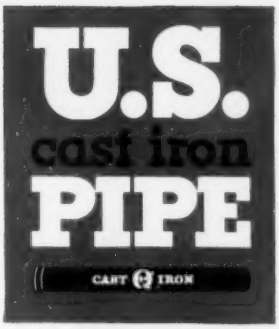
His conclusion is that:

". . . a high level of oil exploration activity is not a prerequisite for adequate additions to natural gas reserves in the coming decade or two. The search for gas alone will become increasingly preponderant as the source of new gas reserves. Obviously, there will continue to be some level of oil exploration activity—the American petroleum industry is not going to

(*Continued on page* 81)

this means precision

so does this



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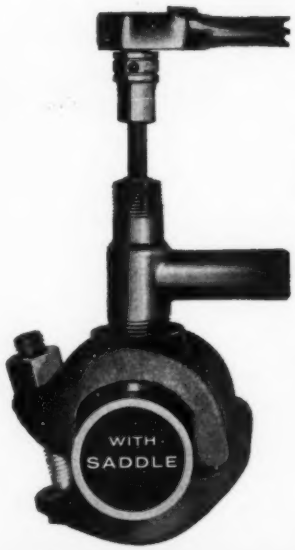

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TECHNICAL TRENDS

By GUY CORFIELD
Professional Engineer,
Los Angeles

Combustion generated oxides of nitrogen as a factor in air pollution.

The nitrogen comprising about four-fifths of our atmosphere is ordinarily thought of as being inert, i. e., will not chemically combine with other elements or substances. The student of industrial chemistry however soon learns about the "fixation" of atmospheric nitrogen. This is the combination of nitrogen and oxygen to form nitrogen oxides. From these oxides nitric acid, fertilizers and other compounds can be formed which contain "available" nitrogen that is chemically active and can be assimilated by plants. The combination can be effected by passing air through an electric arc or through a pebble furnace—a firebox containing pebbles heated to very high temperature. For maximum yields not only is high temperature needed, but the reaction products must be cooled rapidly to prevent decomposition back to the uncombined state. The best obtainable efficiency of combination is relatively low, however, and such processes are not commercially attractive.

In nature, small quantities of oxides of nitrogen are produced in the atmosphere by lightning. And, incidental to man's activities, all forms and types of flame combustion, and electric arc processes, also add small amounts usually measurable only in fractions of a part per million. The normal small concentrations in the atmosphere, less than 0.05 ppm, are harmless and unnoticed. In higher concentrations, however, which can accumulate potentially and sometimes actually in areas subject to air pollution, discomfort and possible health disturbance can arise. Such areas combine high density of population and industrial activity with unfavorable "ventilation"— valleys or other low lying "basin" topography and periods of zero or low wind. Such areas are typified by the Los Angeles Basin which periodically has to contend with its famous (or infamous) smog.

Apart from their possible effect on health when in abnormally high concentration, oxides of nitrogen are considered an important factor in the formation of smog—at least the Los Angeles variety. It is accepted that such smog results from the combination of hydrocarbon vapors (from automotive gasoline, solvents, etc.) with atmospheric ozone and oxygen and water vapor, to form oxygenated hydrocarbon compounds which are eye- and other membrane-irritants. The combination is promoted by sunlight as a photochemical reaction, and catalyzed by oxides of nitrogen with effectiveness proportional to their quantity or concentration.

For these two general reasons the Los Angeles County Air Pollution Control District, as a phase of its continuous monitoring of atmospheric contaminants, has set up a system of "alerts" for advising the public of unusual build-up of oxides of nitrogen (and some other constituents). A *first* alert is declared at 3 ppm, indicating "close approach to maximum allowable concentration for the population at large, still safe but approaching a point where prevention action is required." The *second* alert is at 5 ppm, a level "at which a health menace exists in a preliminary stage." Beyond the first alert, increasing concentration will invoke reduction and control of vehicular traffic and industrial combustion. A first alert has been reached a few times for short periods, but the normal concentration is considerably less.

The LACAPCD also organized a Joint Project for the Determination of Emissions of Oxides of Nitrogen from Stationary Sources in Los Angeles County. Stationary sources were those other than vehicular, on which detailed information already existed. They included essentially the domestic, commercial and industrial combustion applications of natural gas and oil. Natural gas is practically the only domestic fuel and predominantly the commercial fuel used in the area. Natural gas and oil share the industrial load. Practically no solid fuel is used. A census of equipment was made by numbers and types. Sources were generally classified as *small, medium* and *large,* depending on their emission per unit rather than number of units. Domestic and commercial gas appliances fell into the *small* classification. Hundreds of samples of flue gases and combustion products were taken and analyzed by the phenoldisulfonic acid method. Results were expressed as combined nitric oxide, NO, and nitrogen dioxide, NO_2, conveniently referred to as NO_x, and calculated to pounds per million Btu burned, and tons per day emitted to the atmosphere.

Domestic and commercial gas appliances showed up extremely well in the overall picture even though totaling some 6.5 million. Emissions for the various types ranged from 0.027 to 0.11 lb per MMBtu, with an average of 0.076. The calculated total emissions were 10.3 tons per day average in the summer and 24.6 tons per day average in the winter, the difference of course being idle comfort heating equipment in the summer. This compares to a total of all *small* sources of 55 tons per day summer and 113 tons per day winter; or to a total of all *stationary* sources of 200 tons per day summer and 340 tons per day winter; or to a *grand total,* including vehicular emissions, of 550 tons per day summer and 690 tons per day winter.

The results of this investigation are summarized in Report No. 4, "Emissions of Oxides of Nitrogen from Stationary Sources in Los Angeles County." It can be obtained from the Los Angeles County Air Pollution Control District, 434 S. San Pedro St., Los Angeles 13, at a cost of $1.85.

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WASHINGTON

By NEIL REGEIMBAL • GAS Washington Bureau, Washington, D. C.

Government-dictated changes ahead

THE federal government is dictating far-reaching changes in gas industry operations. As the regulatory web is tightened, the squeeze on the industry from wellhead to burner tip will increase.

The Federal Power Commission, with Chairman Swidler firmly at the helm, views the industry in an entirely different light than did the commission under previous leadership. So does the White House.

In another few years, if present trends continue, gas firms will be using different accounting and bookkeeping methods, different supply and price contracts, and probably paying taxes on a different base.

Most of these changes will not be the result of congressional action, but of changing regulatory patterns at the commission. Most of them will not be to the liking of the industry, because they'll clearly mean more government regulation.

Whether gas companies will be in a weaker, stronger, or unchanged financial position as a result only time will tell.

The direction of the change is already set. In the most recent moves, the commission assumed regulation of intrastate gas sales to interstate pipelines regardless of whether the gas is intended for use within one state; banned all indefinite escalation clauses in producer contracts; and will stop issuing temporary pipeline construction certificates.

More of these types of changes can be expected over the next few years.

In the intrastate sale decision, the FPC majority not only reversed past practice, but also decided that a previous court case was "erroneously decided."

Two firms, Lo-Vaca Gathering Co. and Houston Pipe Line Co., proposed to sell gas to El Paso Natural Gas. The first sale would be for use as fuel in El Paso's compressors, treatment plants, and similar installations outside of Texas. The second would be for fuel use entirely within Texas. Neither sale, it was contended, was for resale and thus should not subject the sellers to federal regulation.

The commission majority insists that it is impossible to isolate gas once it is mixed in an interstate pipeline stream. The question, it says, is what is done with gas, not what the parties may say about the transaction, either verbally or in writing.

It also contends that a pipeline could offer some producers higher prices than others, claiming a sale was for use as a fuel, and this would amount to "discrimination" and increase the cost of gas to interstate customers.

Commissioner O'Connor, dissenting, noted the decision departed from judicial precedent. It also precludes the use of interstate pipelines for intrastate transmission unless the producers agreed to become subject to FPC jurisdiction, he says. Terming the results "an unnecessarily harsh imposition" on consumers in producing states, Commissioner O'Connor points to a decision in a 1956 case, upheld by the courts, in which mingled interstate and intrastate gas could be metered off.

The majority said that in as far as the court case and the recent El Paso case are inconsistent, they believe the court was in error.

In preparing to enforce strictly an earlier decision to ban all indefinite price escalation clauses, the FPC is heading for a bitter fight with producers. Last spring, when the FPC announced its opposition to such clauses, the producers protested strongly and many continued to submit contracts containing them. Now, the commission has decided to simply reject outright any proposed contract or certificate application containing them. The so-called favored-nation clause is among those outlawed.

The only exceptions to the order would be limited price redetermination, permitted not more often than every five years, and provisions to cover increases in production or gathering taxes.

The commission contends that escalation clauses contribute to price instability and uncertainty, hurt pipeline expansion, and damage consumers by providing artificial grounds for rate increases.

Producers, probably preparing to take the issue to court, contend that the FPC does not have the power to outlaw such provisions, is restricting freedom of contract, and would deprive producers of their rights.

Decision of the new FPC, as part of its "general policy," not to issue temporary pipeline construction certificates will probably turn out to delay some projects.

In the past, where weather or other emergency circumstances made it necessary, the commission has issued temporary construction certificates without notices of application being issued or hearings held. But no longer.

"While the Natural Gas Act permits the granting of temporary authority under certain conditions without notice and hearing, the commission has, on occasion, inter-

(*Continued on page* 82)

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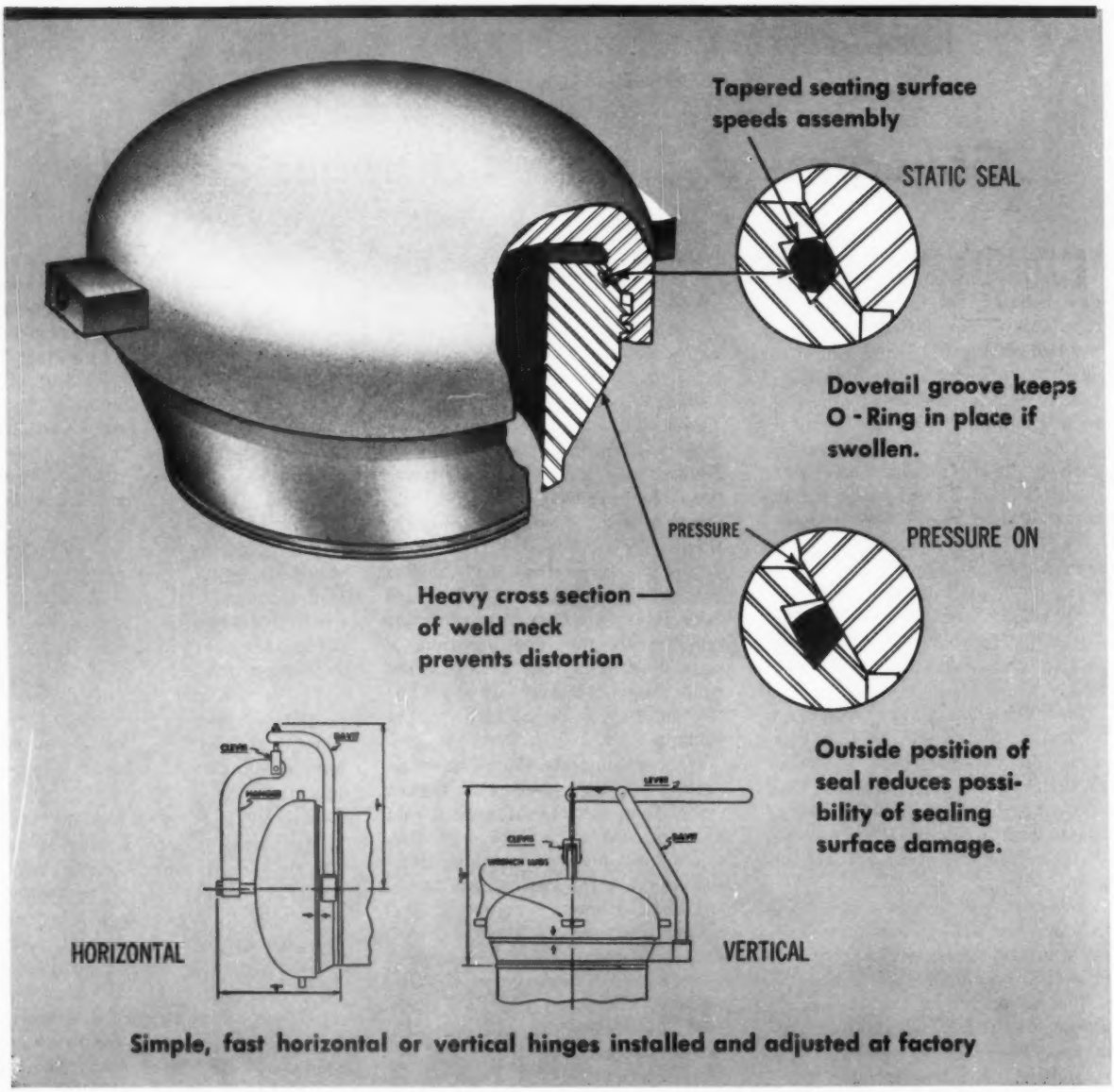
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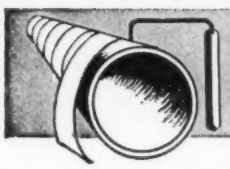

CORROSION PREVENTION

DISTRIBUTION TRANSMISSION

by MARSHALL E. PARKER • Consulting Engineer, Houston

Don't let it happen again!

CATHODIC protection systems, and other corrosion control devices, are subject to mishap and accident like any other part of a company's physical plant. Some of these are very much like any accident, and some are peculiar to the special nature of these systems. One peculiarity, well recognized by some but unfortunately not by all, is that a failure often does not make itself known in any way; no bells ring, no lights flash, no visible activity ceases. But, if protection has been lost, there will ultimately be some leaks where there should have been none. And by the time these come to light, much damage has been done, sometimes over a large part of the system.

One way, then, to minimize the effects of a mishap is to operate a system of frequent inspection or monitoring, using the appropriate instruments and methods, so that failures of all kinds are found as quickly as possible. With cathodic protection systems, this early knowledge of a failure has two advantages; not only is the condition corrected with a shorter loss of protection, but the actual trouble-causing condition is usually easier to locate while it is quite new; very often an investigation of recent construction along the line will spot the difficulty.

Once the accident has occurred, and the trouble has been recognized as such, and then tracked down and located, the obvious next step is to remedy the damage done, and get the system back into proper operation. Doing this may be as simple as replacing a burned out fuse; it may be as complex as relocating and completely rebuilding a rectifier-ground bed installation.

When this has been done, and, in fact, while it is being done, some of the environmental factors which were responsible for the accident should be corrected. Of course, there are cases where nothing can be done in this direction; but even the most routine case should at least be examined to see if anything can be done to see that it doesn't happen again. If an insulated flange has been shorted by a lightning-induced surge in the line, it may be possible to install an anode ground or by-pass; but if the damage has been done by the construction of another pipeline, there is little that can be done expect to try to guess where the next line will—or won't—be laid.

It is still a good idea to try to minimize the total harm done by the accident—and one way in which this can be done is to maximize the beneficial effects; in other words, get as much good as possible out of the experience, not only at the site where it occurred, but elsewhere in the system. Are there other installations subject to the same kind of mishap? Then take whatever steps are necessary to keep the same thing from happening at those locations. When new installations are planned, incorporate features which will tend to keep this kind of accident down. Don't let it happen again.

This is still not enough. If the trouble you had is one not already well-known, then it is your duty to spread the word around, to give warning to other people in other systems, so that they too can be spared a repetition; don't let it happen again—anywhere, in anybody's system. The first step in this direction, of course, is to disseminate the information throughout your own company, in all the divisions. After that, it should be given to the whole industry.

At the same time this last spreading of the word is taking place, there should also be occurring, within your own experience, another form of generalization. This is to say that you are learning to recognize, in a growing number of situations, the factors which are conducive to failure, and to insist upon those characteristics in structures and systems which are most resistant to accidents and to failures. These experiences—both those in your own work, and, more importantly, the vicarious experiences in the work of others, synthesize into that intangible thing called judgment. Judgment cannot be taught, but it can be learned; it cannot otherwise be acquired.

The conscious way to acquire judgment is to generalize all of your experience to the greatest possible extent. It is not enough to observe, from your own experience or from that of others, that he who sits on a hot stove gets burned; this is good learning, but it is not enough. You should also learn that he who sits on anything hot gets burned; this will serve you much better, and over a wider field. Note that the lesson to learn is not necessarily that it is unwise to sit on a stove; this is a poor generalization; that it is unwise to sit on something hot is more suitable.

Finally, don't get either too general or too sanguine. An idea can be so generalized, so rarefied, that no immediate application is visible—as if the hot stove idea were expressed as the general instruction to avoid all contact with anything which could possibly be harmful in any way. This is like trying to insure something against *all* possible hazards—the premiums will exceed the value of the insured property. There will be accidents, there will be mishaps, no matter what precautions are taken. And, in some categories, the probable cost of the accidents is less than the cost of protection. ■

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THE GASSING GAME

By **JIM CLARK** • Gas & Oil Consultant, Houston

JOHNNY Mitchell, a Houston gas producer who is also president of Jade Oil Co., is concerned about a growing tendency toward "take or pay" gas contracts which, he says, are encouraging practices detrimental to good conservation in some cases.

Take or pay agreements are those wherein a transmission company agrees to pay for a specified amount of gas daily whether the total amount is taken or not, usually for short periods of five years or less.

He points out that these are short term contracts which actually obviate FPC review and reserve requirements. His main objection to this system is that in most cases the gas comes from small tract wells that often drain reserves already dedicated, thereby encouraging the drilling of unnecessary wells on tiny tracts. In all cases he says there is no real reserve requirements such as the 7.5 billion cu ft for each million cubic feet daily for dedicated reserves.

Mitchell says he is making a thorough investigation into the system to determine whether or not he should bring it out in the open. He claims that many producers, as well as transmission lines and distributors, are apparently ignorant of the evils involved in the system. He hopes that through explanation he can discourage the practice and avoid a fight.

Gulf Coast oil and gas men know that Mitchell, once he takes up the sword, is no easy man to brush off. So, chances are he will have or is having conferences with gas leaders. If these are satisfactory his blast will probably not come. If they are not, he can be expected to take his message to regulatory authorities, all of the trade associations, the distributors, and the public.

Mitchell says the system works an undue hardship on prudent operators who have been most careful in meeting all FPC reserve requirements in the past. He says, for instance, that he has learned that 500 MMcf of gas daily is being produced from town lot and "unreserved" wells in south Texas and that this is eating into the available market of operators with "responsible reserve holdings."

He points out that the FPC has been approving contracts to build lateral lines without either full knowledge of available reserves or without even considering that such gas comes from already dedicated reserves in many instances. He calls this a "dual contract" system. The most serious aspect of draining the town lot wells, he says, is the harm done to reservoirs, actually making it impossible to ever capture much of the gas in such reservoirs.

Mitchell says that when a small producer or gathering system is able to get a guaranteed daily market with a take-or-pay contract that he is able to finance his project through banks, without considering reserves. He suggests that banks and lending agencies take a look at the system also. Normally, he says, they make loans on reserves, but in the take-or-pay system they are lending money on contracts. In some of these cases, he says, the reserves are questionable and at some point before the liquidation of the loan the lender could find the promoter unable to deliver.

The great cause of this system, Mitchell points out, has been the Texas proration formula which permitted an operator to get a third of a full gas allowable regardless of the size of his tract. For instance, a well on a half-acre tract in the middle of a 640-acre spacing pattern could get a third as much gas take daily as a well on a full 640 acres.

But this system might be ended. The famous Normanna decision by the Texas Supreme Court, and the subsequent order by the Texas Railroad Commission, placed allowables on a full acreage basis. The commission order, however, stated that unless other operators were willing to include small tract operators in drilling units they would be entitled to special consideration, regardless of the size of their tract. Few operators care to include these outsiders in their unitization programs.

Mitchell's feeling on this subject is attracting some important attention because he is seldom on the losing side of a fight. He thinks things out long before he opens up but when he starts firing he does so with all guns blazing, usually with devastating effect on his target. ■

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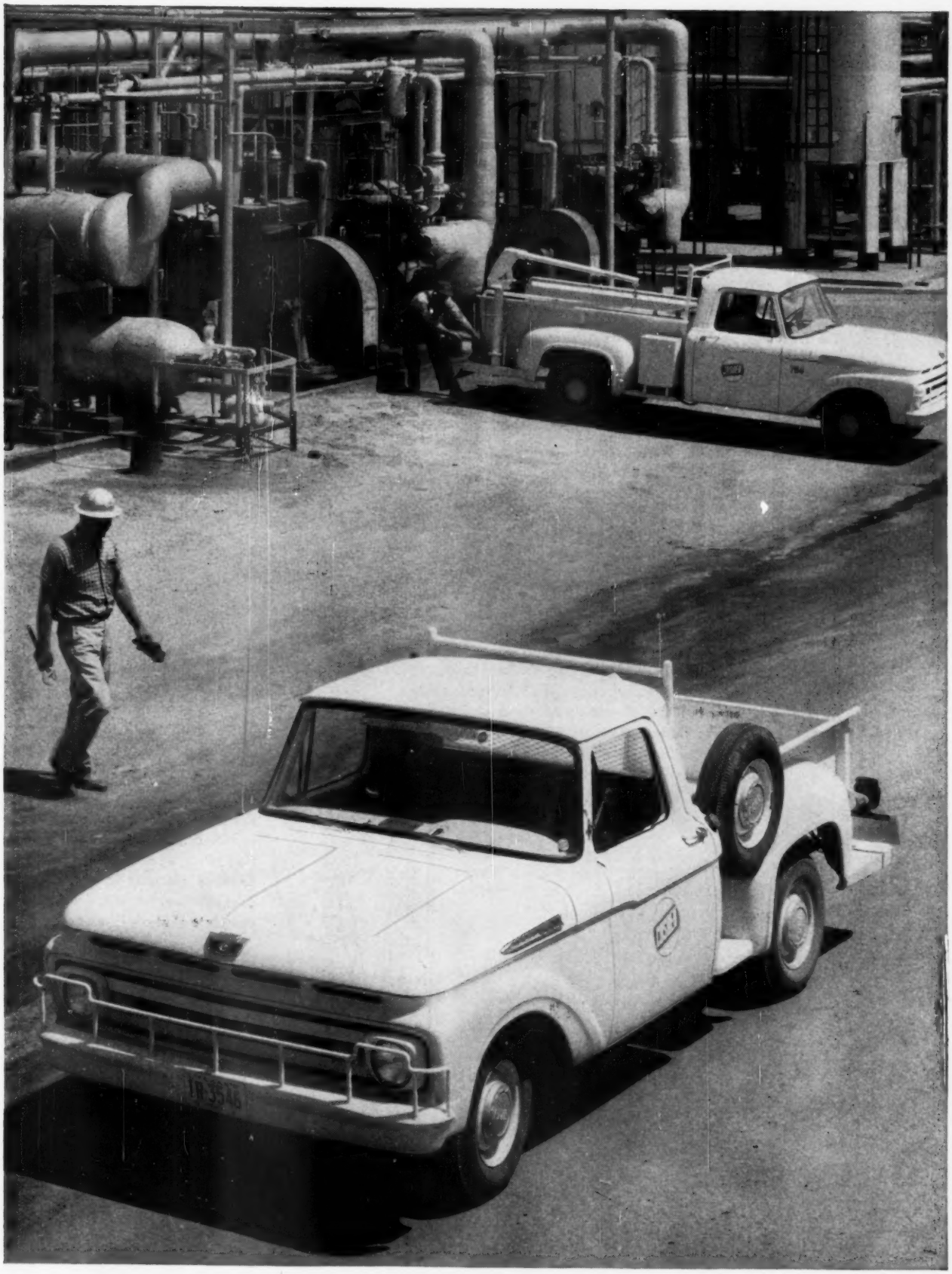

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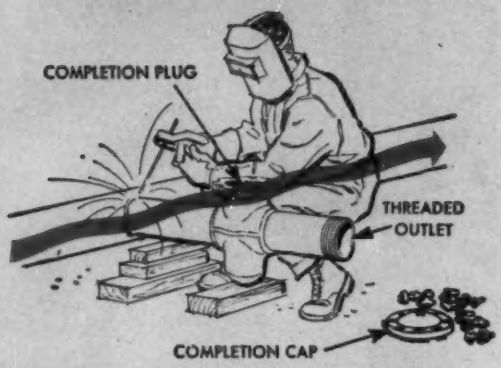

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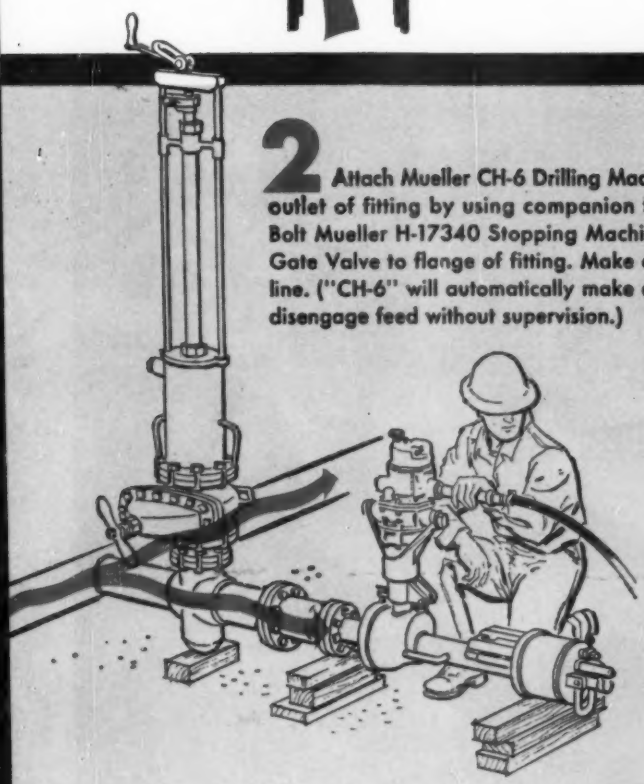
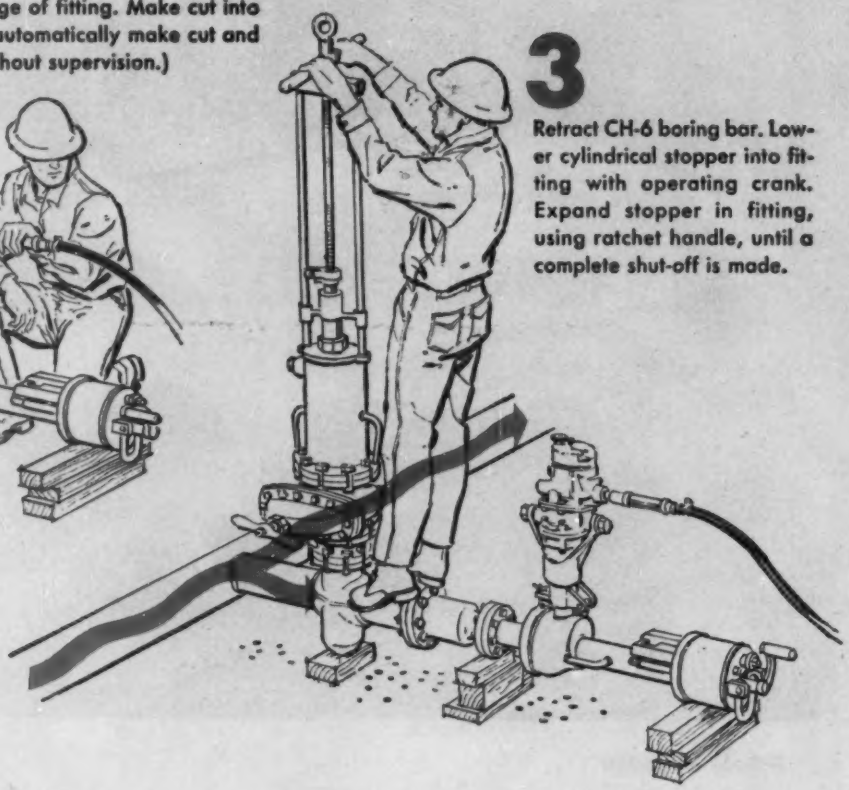


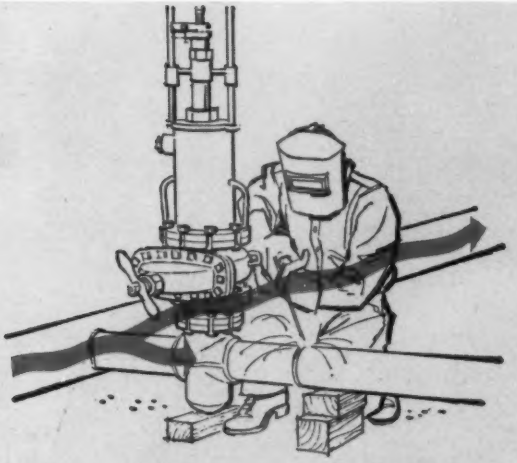
2 Attach Mueller CH-6 Drilling Machine to outlet of fitting by using companion flange. Bolt Mueller H-17340 Stopping Machine and Gate Valve to flange of fitting. Make cut into line. ("CH-6" will automatically make cut and disengage feed without supervision.)



3 Retract CH-6 boring bar. Lower cylindrical stopper into fitting with operating crank. Expand stopper in fitting, using ratchet handle, until a complete shut-off is made.

valves!

MUELLER · NO-BLO · METHOD

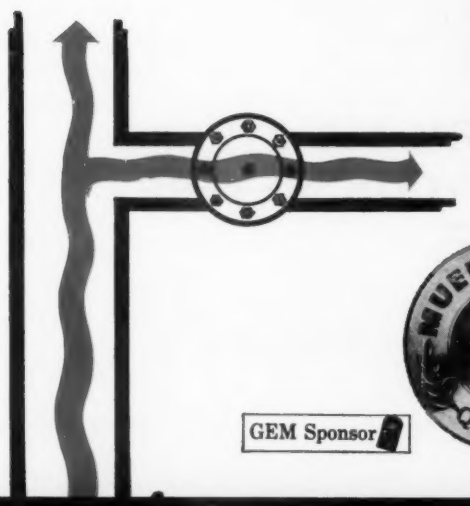


4 Remove CH-6 Machine. Attach new line to fitting and extend to next valve. (Companion flange may be used to connect line or threads may be cut off for welding connection.)

5 Equalize pressure in new line. Contract and raise stopper. Close valve and remove stopping machine. (New piping is now under full pressure.) Bolt Mueller H-17346 Completion Machine to gate valve, open valve and screw completion plug into top of fitting. Remove machine and gate valve and bolt completion cap to flange of fitting.

SOLUTION:

Line has been safely tied in under full system pressure without shutdown or other disturbance to operating facility. Only maintenance-free fitting remains in new line—no valve! Stopping machine may be re-mounted on fitting and line stopped-off whenever needed.



GEM Sponsor

These fittings and machines are just a small part of Mueller's complete system of No-Blo products—products especially designed for use with fluid facilities under pressure.

No-Blo products and methods make it possible to extend dead ends, to transfer service to another line, to isolate a section of line, to repair leaks, to make tie-ins, to run laterals, to install or replace equipment—all under full operating pressure in a safe, controllable manner and without shutdown!

The No-Blo System is typical of the constant attention to detail—and more than a century of experience—in research, design and engineering that is a part of all Mueller fittings and equipment.

Mueller also manufactures a full line of components for water distribution systems, fire protection systems and plumbing systems.

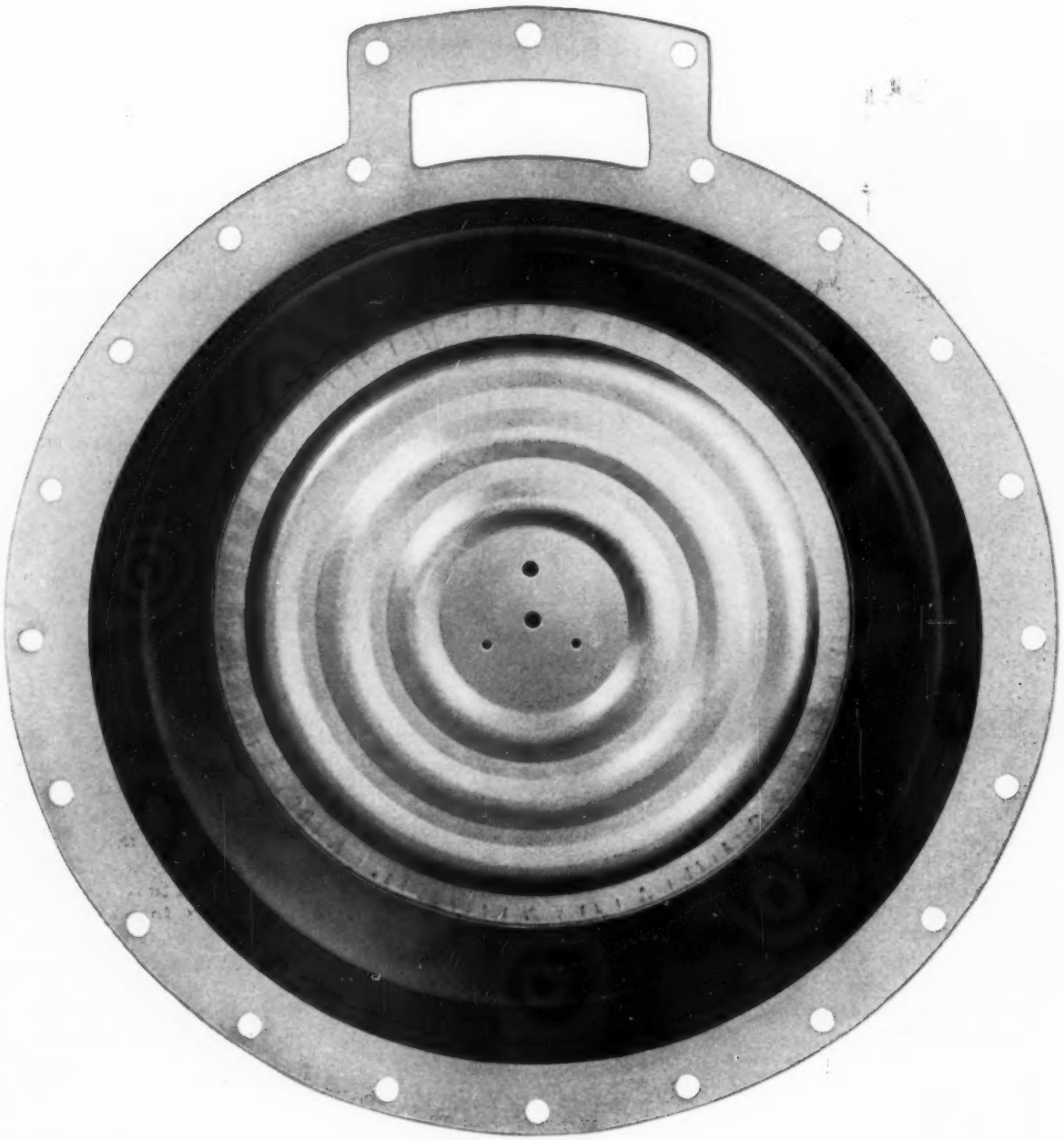
Write for complete information and specifications.

MUELLER CO.

DECATUR, ILL.

Factories at: Decatur, Chattanooga, Los Angeles
In Canada: Mueller, Limited, Sarnia, Ontario

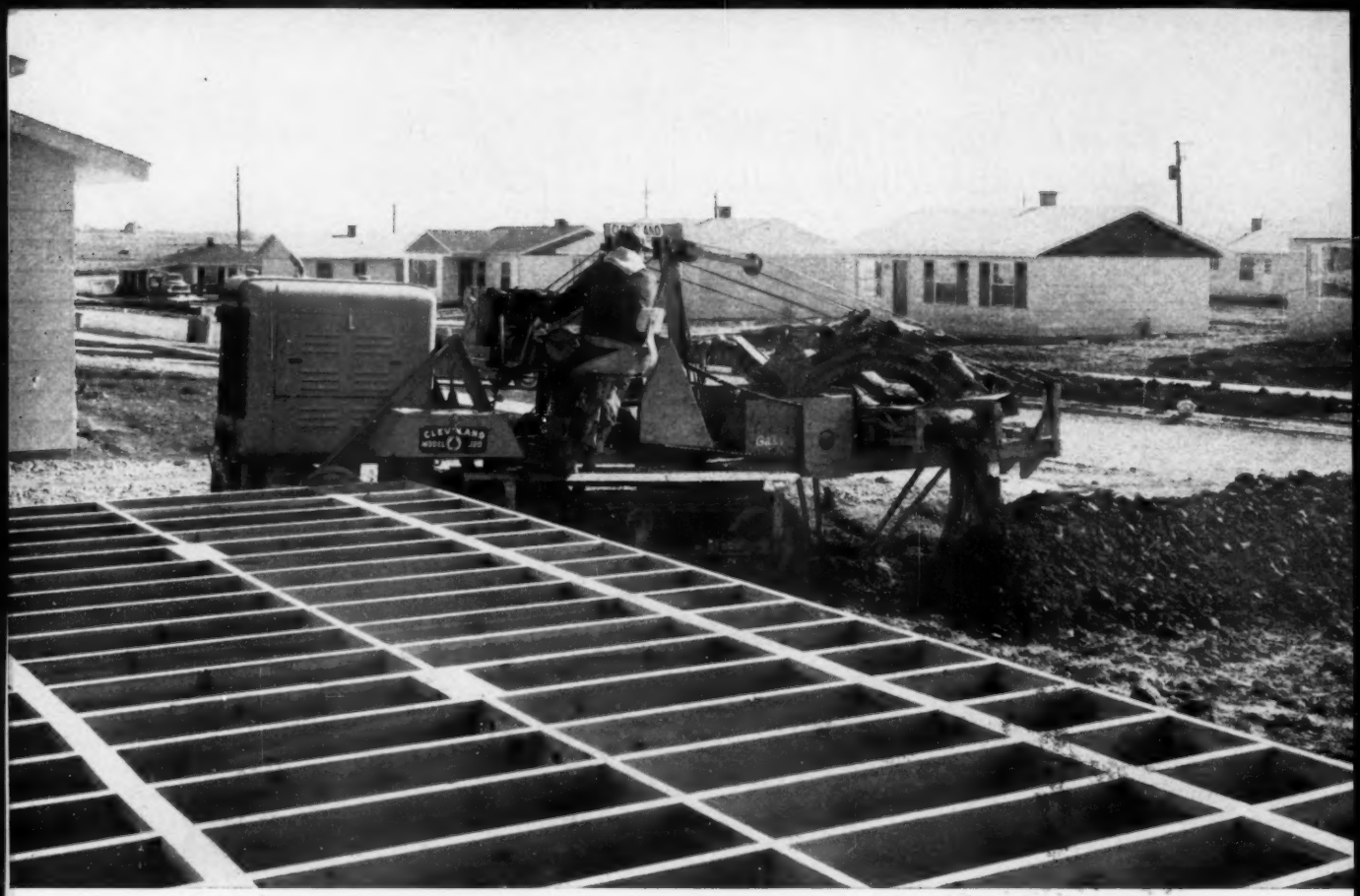
REEVES VULCAN SYNTHETIC DIAPHRAGMS



OUTLIVE AND OUTPERFORM ALL OTHERS. ARE THEY STANDARD IN YOUR METERS?

REEVES
VULCAN

Reeves Brothers, Inc., Vulcan Division, 1071 Avenue of the Americas, New York City, N. Y.



THERE'S NOTHING LIKE A CLEVELAND J-20 FOR DISTRIBUTION AND SERVICE TRENCHING

HERE'S WHY: there's 100% control of every trenching function at the J-20 operator's seat . . . instant side-to-side conveyor shift...independent conveyor-belt speeds to 1,000 FPM . . . instant reverse of discharge direction . . . positive, full-range boom hoist . . . over 30 usable digging speeds, the *right* power-speed combination for every digging condition . . . 100% anti-friction-bearing-mounted, 1,000-hour-lubricated track. The compact maneuverable J-20 truck-loads excess spoil . . . fines spoil for backfill . . . digs dependably in all soils for mains and services . . . simplifies your scheduling problems.

OFF TO THE NEXT JOB—FAST AND EASY!

The J-20 is fast *to* the job as well as *on* the job. Less than 8 feet wide overall, it trailer-loads easily and hustles from job to job behind a utility truck at safe, legal limit speeds.

CLEVELAND TRENCHER

THE CLEVELAND TRENCHER CO., 20100 ST. CLAIR AVE., CLEVELAND 17, OHIO

BODY BY FISHER ROOMINESS

is another reason Chevrolet does better by your fleet dollars

[*right up through trade-in time*]

★★★★★★★★★★★★★★★★★★★★

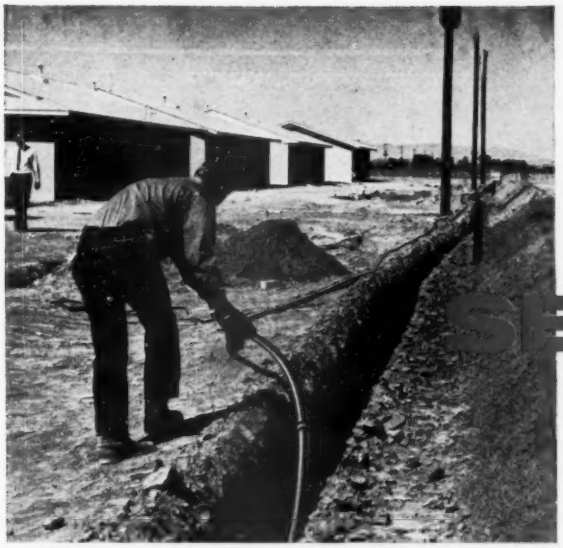
This new Chevrolet gives you the man-sized, down-to-business roominess you want in a fleet car. In fact, Chevrolet went to the extent of using lifelike models to make certain all its '62 models have space to spare, wherever it counts, for relaxing comfort. That goes for head room, leg room, foot room—the works. Those big wide-opening doors are another Body by Fisher advantage for busy fleet schedules. And what Chevrolet does for people, it does for luggage. Nobody else in Chevrolet's field gives you a trunk like this one, with bumper-level loading plus a deep-well floor that lets you take aboard odd-shaped objects other cars just can't accommodate. Add to this all the traditional Body by Fisher advantages—its rugged durability, handsome hardy interiors, through and through insulation against road noise and weather—and you have some of the best reasons why Chevrolet keeps its value longer to bring top trade-in year after year. . . . Chevrolet Division of General Motors, Detroit 2, Mich.

Low-sill trunk design takes lift out of loading. Extra-wide lid allows easy loading from the side.

Foam-cushioned front seat, front arm rests, dual sun visors, cigarette lighter and glove box lock are standard on all '62 Chevrolet models.

'62 CHEVROLET

CHEVROLET



One man can effortlessly ditch 1¼" ABS plastic gas distribution main by merely lifting the solvent welded line and dropping it into the ditch.

Workman demonstrates the lightness of semi-rigid ABS pipe as he carries four pre-assembled 70-foot sections of house service lines to ditching site.

ARIZONA PUBLIC SERVICE CUTS INSTALLATION TIME FOR NEW SUBURBAN GAS SYSTEMS WITH

SEMI-RIGID PIPE *made of* ABS *Plastic*

NON-CORRODING ABS PIPE SYSTEM OFFERS NEW PROOF OF INSTALLATION, MAINTENANCE ECONOMIES

Light-weight ABS pipe is helping Arizona Public Service Company keep pace with the expanding demand for natural gas service in new suburban areas, such as Fairway Estates in Phoenix. For dependable, long service life and safety, this major utility specified ABS pipe in distribution mains and house service lines; now installs up to 35 house services per day with a six-man crew. Ease of handling, ease of joining through solvent welding, and lower maintenance costs are advantages inherent in ABS pipe extruded of CYCOLAC brand polymers by Arizona Plastic Extrusion and Southwestern Plastic Pipe Company of Arizona.

The full story of the unique properties of ABS pipe is told in a remarkable twenty minute motion picture film. For a free private showing, write to Dept. F-12.

BE *ABSolutely* SURE . . .
INSIST ON RIGID ABS PIPE
made of
CYCOLAC®
BRAND POLYMERS
THE BORG-WARNER PLASTIC THAT IS TOUGH, HARD AND CORROSION-RESISTANT

MARBON CHEMICAL WASHINGTON — MARBON B-W CHEMICAL — DIVISION **BORG-WARNER** WEST VIRGINIA

CYCOLAC is the registered trademark of Borg-Warner

Use of tin-lined copper tube for gas service replacement lines requires digging of only two holes as in this west coast installation.

Replace your gas service lines this easy, economical way...with PHELPS DODGE TIN-LINED COPPER TUBE!

Savings can be made in labor costs by using Phelps Dodge tin-lined copper tube for replacement gas service lines. Pacific Gas & Electric Company recently adopted this tube for use in its main-to-meter lines.

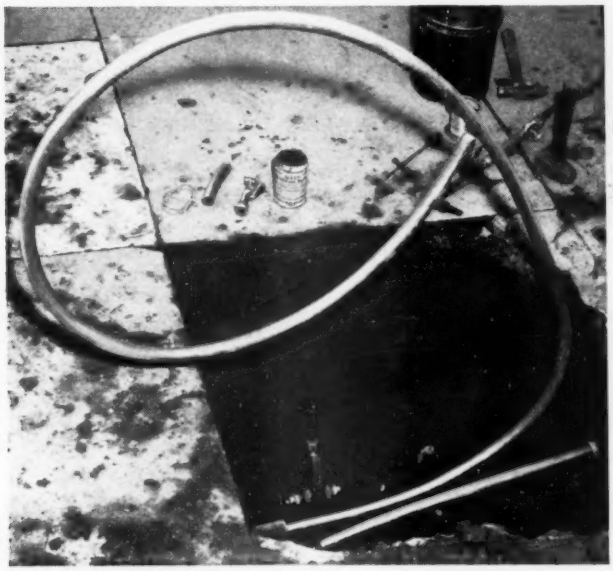
The continuous, inseparably-bonded tin lining provides superior protection against flaking action. The copper tube can easily be bent, flared or soldered and drawn through old steel or iron piping without protective wrapping.

Phelps Dodge tin-lined copper tube is available in long continuous lengths and in sizes from ⅛-inch O.D. to 1 inch O.D. Other sizes available on special order. Sample and descriptive data sent on request.

Just write to the address shown at right.

Workman standing in sidewalk hole where shut-off valve will be connected, is feeding tin-lined copper tube through old iron pipe to gas main.

Tin-lined copper tube emerging from old gas service pipe (right) is attached to 4-inch main in street.



Hole in sidewalk in front of residence showing tubing (right) pulled in from house and tubing (left) coming in from main to be connected to shut-off valve. Local code required shut-off valve to be placed outside of residence.

Tin-lined copper tube has been connected at ground level with steel riser pipe brought up to meter at residence.

PHELPS DODGE COPPER PRODUCTS
CORPORATION
300 Park Avenue, New York 22, N. Y.

P
MINE TO MARKET
D

* "Boy, look at the perfect job this regulator is doing."

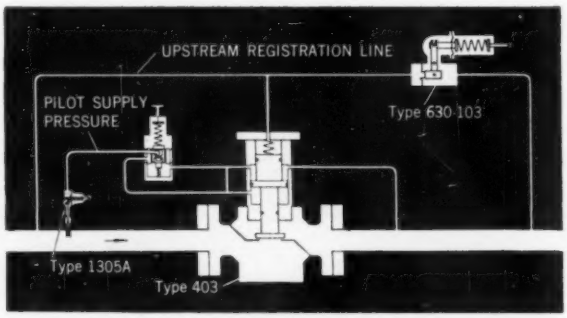
* These are the words of the measurement superintendent of a southern transmission company after seeing the charts of a 4" Fisher Type 403 operating on a widely fluctuating gas load, with flow rates varying as much as 1,500,000 SCFH. Inlet pressure ranges from 350 to 750 psi—outlet pressure was 140 psi. The chart showed a perfect circle with complete absence of cycling. (Actually, on some jobs, the load goes from pilot lights to full load and back again, and the 403 still maintains a perfect circle.)

MAXIMUM PROTECTION AGAINST FREEZING OR MALFUNCTION

To afford maximum protection against freezing or malfunction under all conditions, the Type 403 can be furnished with auxiliary equipment such as shown in the diagram.

The Type 1305A Anti-Freeze regulator utilizes the warmth from the upstream gas flow to provide reduced pilot supply pressure at a temperature above that of hydrate formation, thereby eliminating freezing problems.

The Type 630, installed as an "override regulator" will give assurance that the 403 will continue to supply gas in the event of pilot plugging or malfunction. If the downstream pressure falls below the value set on the Type 630, the 630 will assume control and bleed pressure off the top of the piston in the 403. This permits the upstream pressure in the valve body to lift the inner valve and provide flow to the downstream system.



Both or either one of the auxiliary regulators can be supplied with the 403 as determined by your specific gas reduction job. For complete information write to FISHER GOVERNOR COMPANY, Main Office and Plant, MARSHALLTOWN, IOWA.

If it flows through pipe anywhere in the world ...chances are it's controlled by.....

FISHER® Controls SINCE 1880

McWANE

DUCTILE IRON PIPE

Tomorrow's Pipe-Today

- ★ Corrosion Resistant
- ★ Withstands High Pressures
- ★ Absorbs Shock and Stress
- ★ Bends without Breaking
- ★ Quality Controlled
- ★ Economical to Lay
- ★ Adapts to Rough Terrain
- ★ Service-Proven
- ★ Prompt Shipment

• McWANE DUCTILE IRON PIPE with mechanical joint is the pipe of the future – ready today to solve your piping problems and stretch your piping budget. Strength, toughness, ductility, long life . . . these spell economy and ease of installation – a built-in part of McWane Ductile Iron Pipe. And, the mechanical joint is designed for low or medium pressure gas distribution systems – also for high pressure gas supply lines. Before you buy any pipe, check McWane where Ductile Iron Pipe is a production item – ready to give you real economy.

"Our 40th Year-Making Good Pipe Better"

McWANE CAST IRON PIPE CO.

Write today for this free informative 16-page brochure on McWane Ductile Iron Pipe

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B.F.Goodrich

HERE'S PVC PIPE OF RIGID GEON --THE PLASTIC WITH ALL THE ANSWERS

To every question you ask about what a pipe can do for gas distribution, Geon vinyl gives a positive, money-saving answer. It's light and easy to install. But that's only the beginning.

Geon vinyl in rigid form stands up under pressure, takes the hard knocks because of its unusually high-impact strength. It gives the priceless extra value of eliminating combustion problems: when you ask that question of a plastic, remember the fact that non-sparking Geon will not support combustion —cannot create a problem. Of course, there are no difficulties from galvanic or chemical corrosion, either.

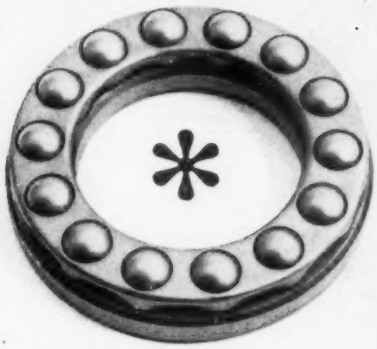
You can see why so many gas companies are switching to savings by changing to PVC pipe—for new lines or for inserts in old ones to restore their serviceability—permanently.

For more facts, including experience of some of these gas companies, write Department NS-6, B.F.Goodrich Chemical Company, 3135 Euclid Avenue, Cleveland 15, Ohio. In Canada: Kitchener, Ontario.

B.F.Goodrich Chemical

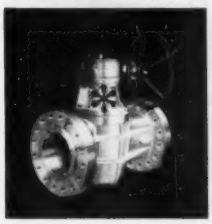
A division of The B.F.Goodrich Company

Geon VINYLS



*This is the secret of Rolotork®

The single-unit plug-and-stem of Walworth's Rolotork Lubricated Plug Valve is mounted like the drive shaft of a fine machine tool. Superhardened ball bearings absorb thrust—as high as 100,000 pounds—yet let the valve operate without an ounce increase in torque! That's



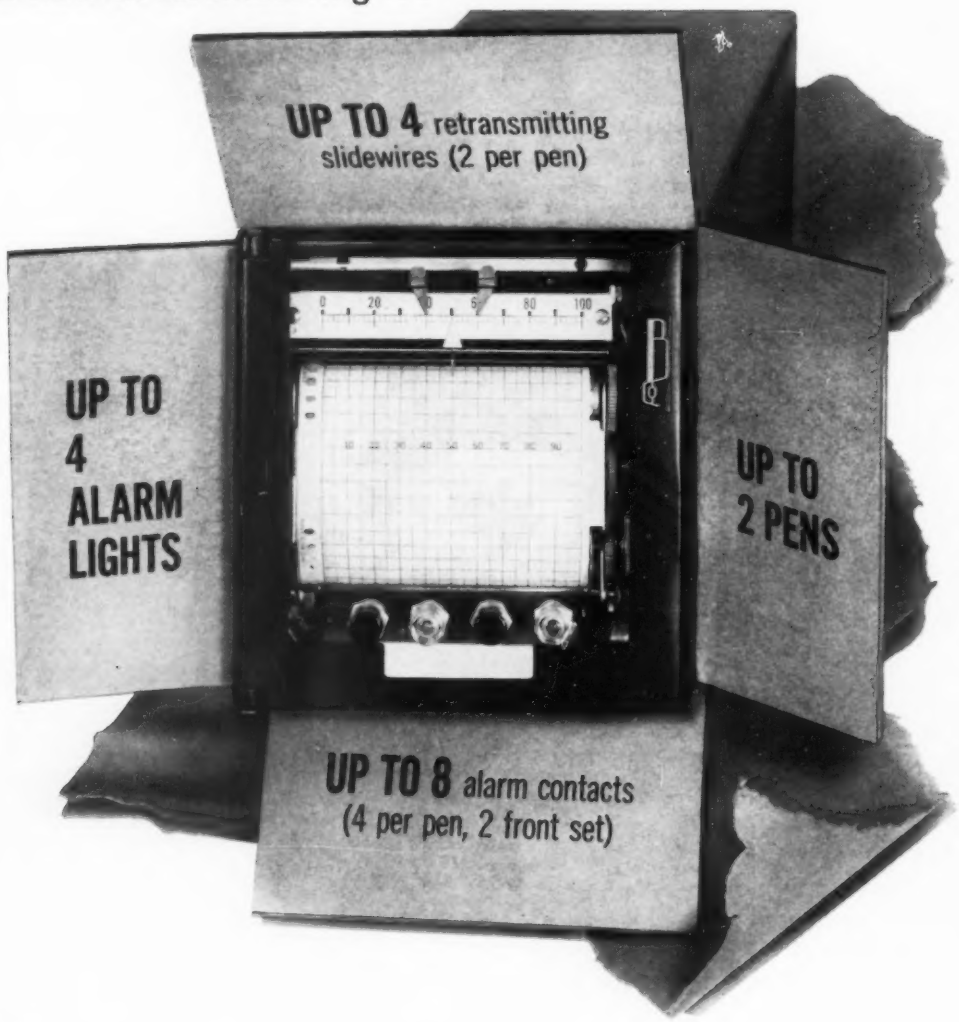
Rolotork—all the advantages of Lubricated Plug Valves—plus fingertip operation at any line pressure. ■ And remember, the famed Walworth Service Fleet stands ready, day and night, to service your LPV's and instruct your operating personnel. Call or write today.

Executive Offices: 750 Third Ave., New York 17, N.Y. Lubricated Plug Valve Division: 3517 Polk Ave., P.O. Box 18211, Houston 23, Texas

WALWORTH **WALWORTH**

the Walworth companies: Alloy Steel Products Co.—Conoflow Corp.–Grove Valve and Regulator Co.–M&H Valve and Fittings Co.

What's new in telemetering . . .



NEW! compact receiver package that gives you everything!

New Bristol Series 670 Metameter* Telemeter Receiver is the first *truly compact* instrument that gives you every feature you need for efficient operation of central dispatching facilities.

■ **It's compact, with big performance:** Only 7" x 7⅛" panel space; yet 4-inch strip chart gives you same-size record as much larger, standard round-chart instrument.

■ **It's more versatile:** Series 670 offers you more options, far more accessory equipment than other compact or miniature instruments: one or two pens; up to 4 retransmitting slide wires (two per pen); up to 2 front-set alarm contacts and up to six easily accessible, easily adjustable alarm contacts, each with an individual scale, inside case —a total of 4 alarm contacts per pen. Up to 4 alarm lights may be panel mounted. **T.M. Reg. U.S. Pat. Off.*

■ **It's easier to operate and service:** Chart changing is a one-hand operation—*takes only seconds.* Capillary inking system can be filled from front. Chart tear-off and rewind provisions. Famous Bristol human-engineered scales and pointers. Rectilinear chart coordinates.

■ **It's easier to maintain:** Full plug-in construction, with sparkless mercury-switch disconnect, lets you replace entire instrument in seconds if need arises.

The new Bristol 670 Metameter* Receiver is available for both 5 and 15 second impulse duration systems, with a wide choice of charts for every telemetered variable. Let us send you complete data. Write:

The Bristol Company, 119 Bristol Road
Waterbury 20, Conn.
A Subsidiary of American Chain & Cable Company, Inc.

ACCO

BRISTOL . . . leader in instrumentation for the gas industry

1.27 AUTOMATIC CONTROLLING, RECORDING, LOGGING AND TELEMETERING INSTRUMENTS

...snow
...rough ground delay your distribution line-work

If you are extending service into new subdivisions and fringe suburban areas, it will pay you to equip each crew with an all-weather Case 310 *Utility* Backhoe-Loader. This crawler digger outworks competitive rigs on construction and medium-to-large repair jobs . . . saves delays because it is easily transported.

High-flotation Model 310 gives you ground-grip to get-in, work, and get-out of practically any footing. It cuts trenches thru mud, in snow, on rough ground . . . works more "bad" days, so each crew finishes more work in a year. You save "rain-out" wages, boost productivity of supervisors . . . may need fewer crews, less equipment. In dry weather 310 works even better . . . won't mar pavement and most asphalt. Rubber-padded tracks also available.

For major construction and relocation at freeways and re-graded streets, Case 310 Backhoe gives you 14′ dig-depth. Reaches over 16′ from pivot, loads into highest trucks, shortens dig-dump time with exclusive foot-controlled 180° swing. Powered by Case-built *high-torque gasoline or diesel engine*, 310 tractor gives you 5815 lbs pull and push-power for front-loading ¾-yd bucketloads fast. Loader lifts 3500 lbs, dumps into high trucks with hardly a stop. Control is so simple, any operator will feel "right at home".

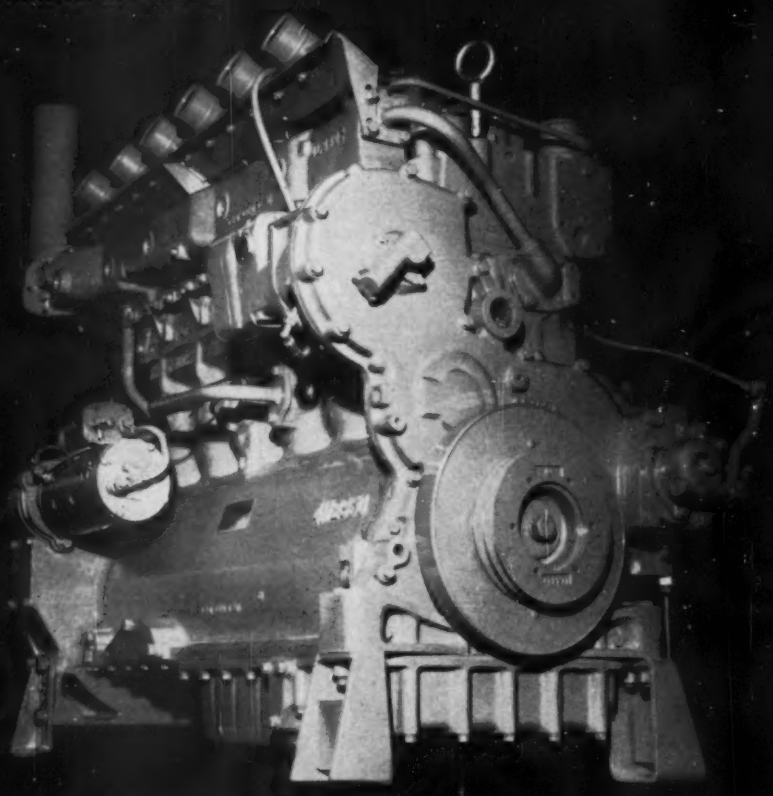
See how Case 310's all-weather dig-power can step-up your construction schedule while reducing per-foot trench cost. Call your Case Dealer for a free demonstration. Or write to J. I. Case Co., Racine, Wis., Dept M139I for complete information.

CU-BL-302

CASE®

J. I. CASE CO., RACINE, WIS.

Caterpillar announces the G333



A significant advancement in small natural gas engines

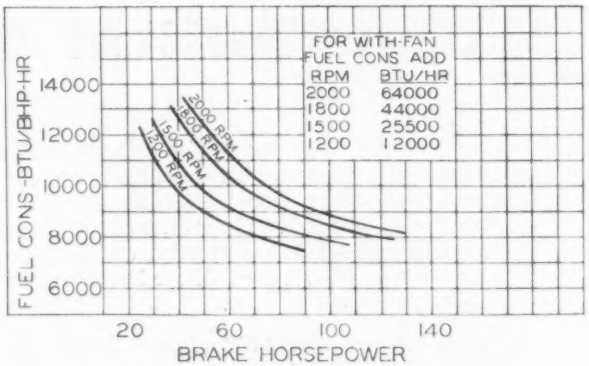
• Outstanding longevity • Outstanding fuel economy

Now, the same basic features that have earned Cat Natural Gas Engines industry-wide recognition for long life and low cost operation are yours in the new G333. The compact G333, like all Cat Natural Gas Engines, is a direct conversion from its diesel counterpart giving you full advantage of diesel strength for the less strenuous demands of gas operation.

Results: Up to 25,000 hours of operation before overhaul . . . higher compression ratios for optimum fuel efficiency and increased output per cubic inch displacement . . . continuous full rated power, derating only for altitude and temperature. Another cost saving feature of the G333 is the low-tension ignition system which is standard equipment. This system makes higher compression ratios practical and extends breaker point and spark plug life.

The new G333 develops 130 HP @ 2000 RPM and 75 KW as an 1800 RPM Cat Electric Set. It is available in compression ratios of 12:1 for processed natural gas and 8.5:1 which allows burning of a wide variety of gaseous fuels, including well-head gas.

For further information on the G333, contact your Caterpillar Dealer or write direct. The Cat Natural Gas Engine line ranges to 720 HP and 450 KW.



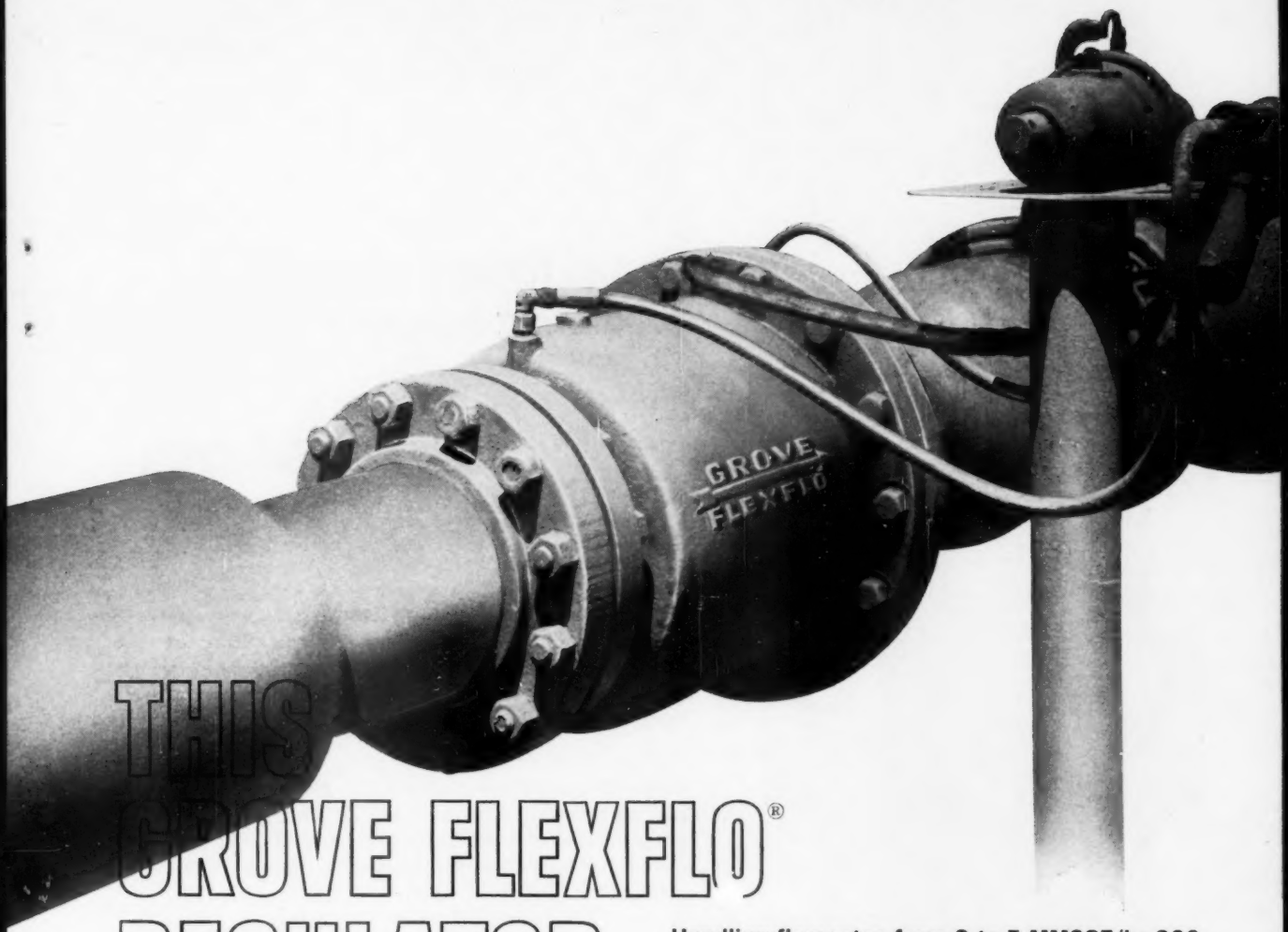
Fuel consumption for G333 (12:1 compression ratio) based on 1000 BTU low heat value fuel.

CATERPILLAR

Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

Engine Division, Caterpillar Tractor Co., Peoria, Ill., U.S.A.

Diesel and Natural Gas Engines • Electric Sets
Diesel Marine Engines • Diesel Truck Engines



THIS GROVE FLEXFLO® REGULATOR IN THE LINE 5 YEARS WITHOUT SERVICE

Handling flow rates from 3 to 5 MMSCF/hr 300 psig to 380 psig inlet, 53 to 55 psig outlet pressures

This 8" model 80-820 Flexflo has been under the above service without maintenance for over 5 years at Pacific Gas and Electric Company's Moss Landing plant. A similar "standby" unit has never been uncrated. There are many case-proven examples of the reliability, dependability and maintenance-free service of Grove Flexflo pressure reducing and relief regulators. Such service, plus the amazing simplicity and versatility of Flexflos, makes them worthy of your consideration. For complete technical presentation, write for Bulletin 800.

GROVE REGULATORS
GROVE VALVE AND REGULATOR COMPANY
A subsidiary of Walworth
6529 HOLLIS STREET • OAKLAND 8, CALIFORNIA
Offices throughout the U.S. and in Western Canada

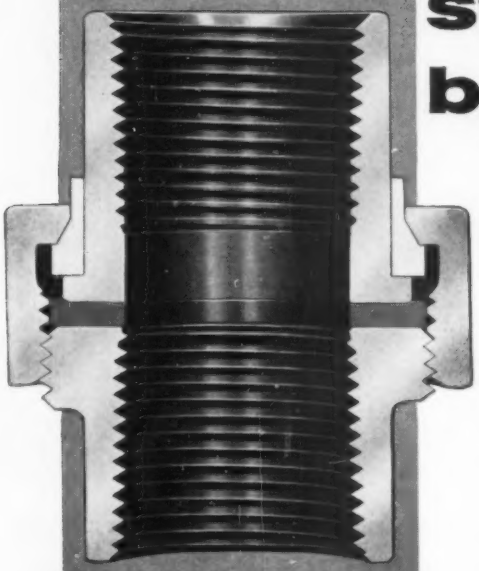
7233

1.

Maximum safety — Through the strength of steel. No sand holes, no porosity.

2.

Extra strength — Original heavy-duty tapered insulator is three times stronger than light, square type.



3.

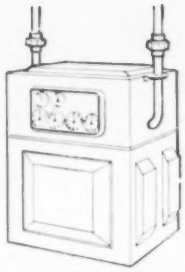
Leak-proof — Full-formed threads assured by Army-Navy gaging procedure.

4.

Quick identification — Easy-to-see color coding: Special-orange; High Temperature-yellow.

SPECIFY CAP FOR ALL FITTINGS

SOLD ONLY THROUGH RECOGNIZED DISTRIBUTORS



install meters with insulating unions—

stop "corrosion by electrolysis"

Corrosion engineers specify CAPITOL gas service insulating unions for meter installations. Stray or induced house currents in the gas lines are stopped, preventing electrolysis and damage to piping and meters.

CAPITOL's insulating unions were designed specifically for gas service to meet the requirements of leading corrosion engineers. Performance proved by years of service. Available in two types: The *Special* insulating union is recommended for normal applications; the *High Temperature* insulating union, designed for maximum protection against gas leaks in the event of fire, withstands 450°F external heat for one hour.

Add to the life of your company's gas mains. Use CAPITOL performance-proved gas service insulating unions on all meter installations.

CAPITOL MANUFACTURING CO.

Division of Harsco Corporation, Columbus, Ohio

CAPITOL

Uncoiling 1¼-inch pipe made of MARLEX during the recent installation by North Carolina Natural Gas Corporation, Fayetteville, N. C. This 400-foot coil of tough, lightweight plastic pipe is easily handled by two men. The MARLEX pipe for this job was supplied by Glamorgan Plastics, a division of Glamorgan Pipe and Foundry Co., Lynchburg, Va.

North Carolina Natural Gas Corp. switches to tough, non-corroding pipe made of MARLEX*

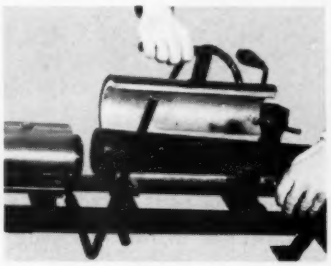
Their first "trial installation" was some 3,000 feet for natural gas distribution to farm homes and tobacco curing barns near Goldsboro, N. C. Taking-off from a transmission line, 1¼-inch MARLEX pipe was used for distribution. Service lines to farm homes and barns were ¾-inch MARLEX pipe.

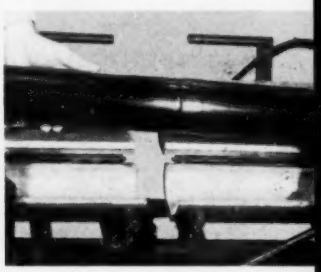
Mr. Bob Wiseman, District Superintendent at Goldsboro says, "We have used other plastic pipe, but as a result of this successful trial, we have switched to MARLEX pipe and are now installing an additional 50,000 feet . . . and more installations are in the planning stage. It's rugged, durable, low-cost pipe . . . lightweight, easily handled and very economical to install. We use steel compression couplings and fittings because we have long runs with very few joints."

North Carolina Natural Gas Corp. is one of an increasing number of gas utilities choosing pipe made of MARLEX high density polyethylene . . . for new direct-buried installations, or for inserting in old mains and services. Available in sizes from ½ inch through 10 inches in coilable and straight lengths, pipe made from MARLEX TR-212 (ASTM Type III polyethylene) has been thoroughly field-tested for natural gas service. It's virtually indestructible . . . resistant to solvents, acids, alkalies, oils, bacteria, rot and fungi. Weighing about ⅛ as much as equivalent steel pipe, it's easy to ship and handle . . . can be economically installed without heavy equipment.

*MARLEX is a trademark for Phillips family of olefin polymers.

With MARLEX . . . proven, economical joining reduces installation costs.





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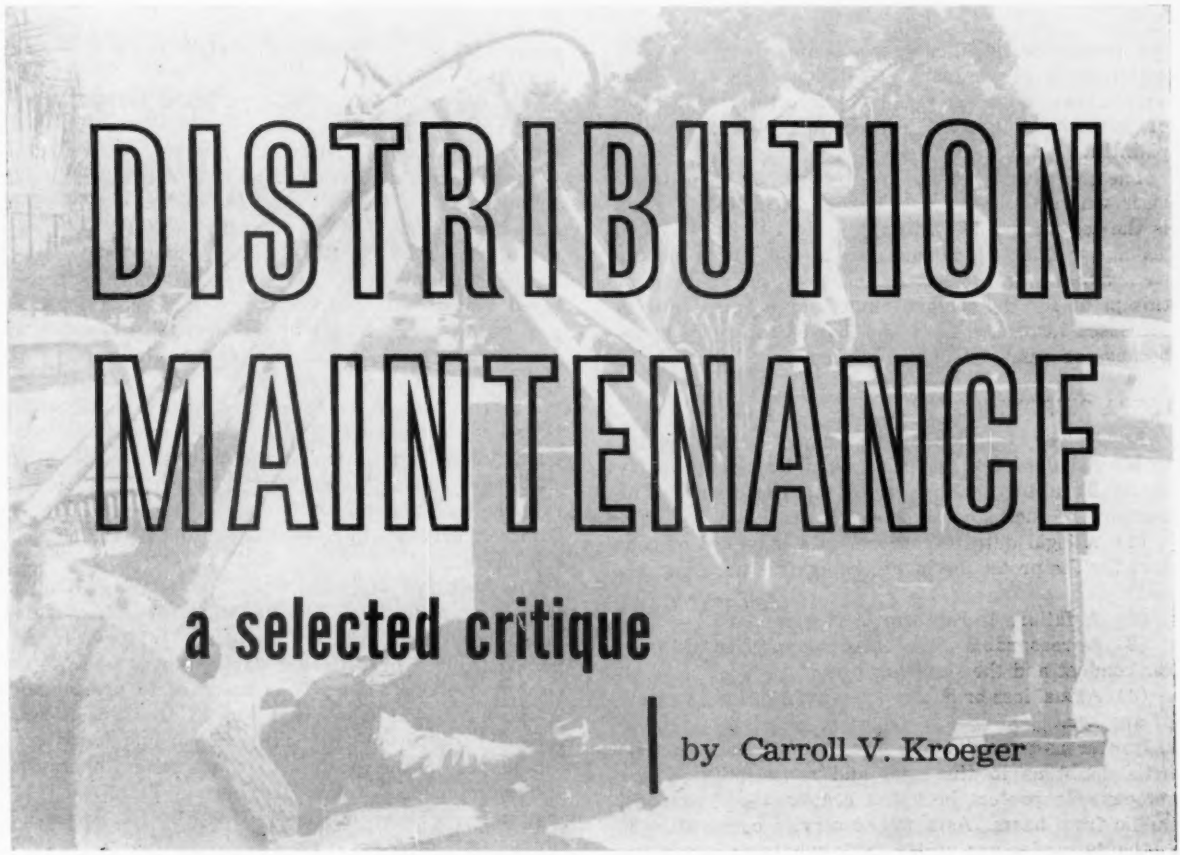


DISTRIBUTION MAINTENANCE

a selected critique

by Carroll V. Kroeger

Mr. Kroeger is Senior Gas Engineer, Stone & Webster Corp.

SINCE the objective of business management is to minimize losses, maximize profits, and perpetuate the enterprise, it is normal for a utility to provide for accident protection by means of liability insurance. This usually is an umbrella of excess liability coverage above the self-insured level. Insurance companies like any other business enterprise are profit-making organizations and rates are established based upon gas industry experience and, to some extent, individual company records. Premiums must keep pace with trends in the cost of claims and the needs for increased amounts of insurance. Insurers provide more than protection through a constant policy of conservation. The safety engineering department of the insurance company provides valuable help to the individual company and the industry. Typical of this assistance are the statistics of excess liability losses *(Table 1)*.

On occasion claims may be settled out of court without admission of liability or responsibility. While this may seem strange to the company employee, the utility's position in the community must be recognized. Public relations must be viewed from the perspective of the company's present and future position in the community. There are instances where relations with the consumers would suffer irreparable harm in the light of prolonged litigation even though the company eventually might win a favorable court decision. Certainly there must be a regard for the social consciousness of juries who have had a tendency to award large damages to plaintiffs against corporate defendants. The real legal problem, even in

the absence of negligence, would appear to be one of social policy of whether the defendants in such cases should bear the losses resulting from the complexities of modern civilization rather than the individual plaintiff.

The gas utility easily can become a "three-time" loser where excessive gas leakage is involved. First is the cost of gas lost through system leakage. When leakage results in damages to others, the company pays again. Unfortunately the costs do not end at this point for the company must pay a third time in increased insurance costs and loss of future revenues because of damaged public relations.

LEGAL RESPONSIBILITY

Any cause of action against a gas utility related to alleged damages resulting from leakage probably would be a tort action related to negligence. The elements of such a cause of action are:

(1) A legal duty to conform to a standard of conduct for the protection of others against unreasonable risks.

(2) A failure to conform to the standard.

(3) A reasonable close casual connection between the conduct and the resulting injury.

(4) Actual loss or damage resulting to the interests of another.

Insofar as a gas utility is concerned there can be little doubt as to the legal and moral duty of the company to protect both the consumer and general public from harm. As a public service corporation it is the duty of a gas utility to do whatever is reasonably necessary for public safety, as well as provide accommodations and facilities for public service. It is the duty of the corporation to provide the necessary protection to avoid doing harm to others. The company has a duty to exercise reasonable care and the individual has a corresponding right to be free from negligent injury.

The degree of care owed by a public servant varies with the circumstances. The amount of care is small where little danger is present. However, where there is great danger a corresponding duty exists to exercise greater care. *"Dynamite must be handled with greater care than bricks."* A gas company deals with a product which can be explosive, and care must be exercised in the handling of it. However, it usually is recognized that in the distribution of a product such as gas, water, or electricity under legislative sanction of franchise there is no strict liability for damage in the absence of some negligence.

The real matter for concern of utility management is the conformance to a reasonable standard of conduct. In the application of the standard, evidence of customary conduct is relevant; however, as a general rule the fact that an act is done in the usual manner is merely evidence to be considered and is not in itself conclusive.

The standard of conduct may be established by a statute or ordinance. The violation of such a legislative enactment may be negligence in itself if the person injured or suffering damages was one of the class of persons the law was designed to protect and if the harm which occurred was of the type it was intended to prevent. Standards of conduct have been established in the matters of construction, operation and maintenance of gas distribution facilities. The minimum requirements are set forth in the American Standard Code for Pressure Piping ASA B31.8-1958 Gas Transmission and Distribution Piping Systems. In many localities these standards have been enacted into state, county, and municipal statutes or ordinances. In some instances more rigid and strict requirements have been enacted. It is significant that Chapter V "Operating and Maintenance Procedures" states as a basic requirement that each operating company shall:

(a) "Have a plan covering operating and maintenance procedures in accordance with the purpose of the Code.

(b) "Operate and maintain its facilities in conformance with the plan.

(c) "Keep records necessary to administer the plan properly.

(d) "Modify the plan from time to time as experience with it dictates and as exposure of the public to the facilities and changes in operating conditions require."

It also is significant that the Code states in the introductory paragraphs of the chapter on Operating and Maintenance Procedures that such procedures "will be entirely adequate from the standpoint of public safety." Provisions of the ASA Code are recognized in the National Fire Protection Association Standard "Gases in Manholes and Sewers." The con-

TABLE 1

Excess Liability Losses of Gas Utilities (1/1/55 to 6/1/59)

	%
Failure to maintain a comprehensive and complete leak detection program	34.5
Failure to protect mains or service lines endangered by operations of contractors	31.8
Gas line breaks due to earth movements	14.4
Failure to investigate all leak reports and make prompt repairs	2.2
Failure to install or repair appliances properly	2.1
Failure to use approved methods and procedures to check leaks after making repairs	1.3
TOTAL	86.3

From Johnson AGA paper 9/28/59.

cluding statement of this standard states that effective hazard control requires the cooperation of the various utilities and administrative bodies in providing an adequate safety program. It recommends that utility companies adopt definite programs to minimize lost and unaccounted-for gas. The publication also recommends that distribution system maintenance programs be carried out in accordance with Section 8 of the ASA B.31.1 Code for Pressure Piping.

The operating and maintenance standards of the ASA Code have been in effect since 1955. Any distribution utility manager probably believes or assumes that his operating procedures were designed from or conform with these standards. The manager probably also assumes or believes that these procedures are followed by the operating personnel. Certainly anyone connected with the gas distribution business knows that safety of customers and the public is an important phase of the business, and that no one would knowingly allow an accident to occur.

How then can a utility be negligent, or a management lax? The courts have said in cases of negligence that it is not enough that a defendant did the best he knew how. In negligence the actor does not desire to bring about the consequences which follow, or believe that they will occur, but a reasonable man in his position would anticipate them, and guard against them. Thus professional men in general, and those who undertake any work requiring special skill, are required not only to exercise reasonable care in what they do or do not do, but also to possess special knowledge and ability. How can management be certain that maintenance procedures are in conformance with the best safety practices and that their costs are reasonable? An increase in the maintenance budget is no guarantee of safety. An audit of the maintenance plan and procedures may be the best approach.

Such audit provides not only a review of the program and procedures, but also checks on the administration of the program. Programs may be sound but due to misinterpretation or improper application may not be accomplishing the desired objectives. Changes in techniques are constantly developing and basic plans may need modification.

DEVELOPMENT OF A COMPREHENSIVE COMPANY PLAN

The basic objectives of any distribution maintenance program are three-fold. All hazardous conditions must be eliminated, losses of gas due to leakage must be reduced to minimum levels for safety and economic reasons, and the distribution system must be perpetuated.

Following are some of the steps in programming the means of reaching these basic objectives:

(1) Institution of leakage detection programs to locate all hazardous conditions.

(2) Repair of all hazardous conditions promptly and follow-up of repairs with an inspection program to insure hazard elimination.

(3) Investigation and determination of the physical condition of the existing system.

(4) Installation of all new construction to be virtually corrosion proof and leakage free.

(5) Establishment of a long-range schedule for replacement to eventually upgrade old existing systems to trouble-free status.

(6) Institution of methods to protect physical property from damage by outside contractors.

Analysis of Indemnity Life Insurance Co. of North America statistics of excess liability losses of gas utilities from Jan. 1, 1955 to June 1, 1959 reveals that 38 per cent of the losses resulted from failures related to leakage detection, prompt investigation and repairs of leakage, or proper inspection after repairs were made.

Excessive leakage from gas mains, services, and other facilities can create hazardous conditions. When combined with a source of ignition, gas leakage may cause fires and explosions resulting in property damage, personal injury and loss of life. In addition to creating hazards, the gas lost through leakage may be a major cost item in company operations. In most cases gas leaks occur at the joints of mains and services. Leaks which are not located near joints usually result from cracks or holes in the pipe. These may be caused by breaks in the main or as a result of corrosion. In the case of cast iron mains, leaks may occur at every joint, or at isolated locations. Regardless of the cause of the leak, it is advantageous to determine the location of such leakage with a minimum of excavation. The minimum requirements for routine leakage investigation are set forth in the ASA Code which states that each company shall set up in its

Fig. 1. Mobile infra-red analyzer can detect 5 parts per million of ethane in air. This survey method provides a rapid, economical detection and a graphical record which can be used for repair and replacement analysis. Amplitude of trace on graphs can be related to leakage rates.

operating and maintenance plan provision for making periodic leakage surveys.

The types of surveys are designated to be one or more of the following: (1) gas detector surveys; (2) vegetation surveys; (3) bar test surveys; (4) pressure drop surveys; (5) soapsuds testing on exposed pipe and fittings; (6) some other effective procedure for locating leaks in underground piping systems.

GAS DETECTOR SURVEY

The gas detector or street-opening survey involves areas in which little or no vegetation is present, and the soil surface is covered extensively by concrete or other hard surface material. This surface material forms a ceiling for any gas which may escape under the street or sidewalk. Natural gas is lighter than air and will follow the path of least resistance into manholes, sewer lines, conduits, or other street openings.

Leakage of gas into a substructure opening presents one of the factors which contributes to a hazardous condition. When gas diffuses into an underground structure blending with air, a mixture within combustible limits may result. (For natural gas concentrations of gas in air between 4-14 per cent.) Such a mixture coincident with a source of ignition can cause fire or explosion. Some sources of ignition are: (1) flames (welding and cutting torches, matches, etc.); (2) burners on street surface maintenance; (3) auto or motorcycle exhust; (4) static electricity; (5) pedestrian smokers.

The gas detector method involves testing with a gas detector instrument all street openings that might vent or collect leaking gas.

VEGETATION SURVEY

The vegetation method has been recognized as an effective means of detection of leakage on gas distribution systems where sufficient trees, shrubs, and grass are present to allow a conclusive survey. Leakage in large quantities from a main or service will displace the normal soil atmosphere. Discoloration of the plant life may be due to gas replacement of oxygen in the soil which is necessary to support vegetation. Plant damage depends upon a number of variables; length of time the leak has existed, volume of gas passing into the soil, specific gravity of the gas, and the amount of moisture present in the soil. Slight leakage can stimulate vegetation causing excessive growth of grass, premature budding of trees and plants, and early bearing of berries, vines, and fruit trees.

Survey crews normally consist of two men, a driver and an observer. The driver proceeds at a speed of no more than 10 miles per hour, while the observer checks all vegetation on both sides of the street for possible evidence of gas leakage. Discolored or dead lawn, or other unusual variations are checked by probing the affected area and testing a sample of the atmosphere with a combustible meter.

BAR TEST SURVEY

The barring investigation normally is conducted subsequent to other inspections in areas where gas leakage has been detected. The general purpose of this method is to determine if there is leakage under a hard surface area and to pinpoint the source location. This is accomplished by locating the main or service with a pipe locator or from physical measurements, drilling through the hard surface and checking the atmosphere with a gas detector. Bar holes normally are drilled over the main or service within the limits of the original trench at 20- to 25-ft intervals. Gas readings usually will be highest at the point closest to the source of the leaking gas.

Where pipe or soil conditions are known to be bad and frequent checks are necessary, paving inserts may be installed. These allow frequent testing without breaking the hard surface each time.

PRESSURE DROP SURVEY

The pressure drop survey is conducted on sections of pipe which can be isolated by closing valves and observing the rate and amount of pressure reduction. Observation of any consumption during the survey by customers connected to the line must be taken into consideration in calculating the leakage rate of the pipe system.

CUSTOMER PREMISES INVESTIGATION

Customer premises surveys usually are made as a result of leakage discovered by one of the other survey methods, or in business sections as part of the regularly scheduled survey program. The method involves actual entry into the building basement or crawl space to locate possible street, service or appliance leakage. Exposed pipe is inspected by soap testing, and use of pit gauges to determine pipe condition. Condition of the meter set assembly and meter support also may be checked.

PUBLIC BUILDING SURVEY

This investigation is a combination of the bar test investigation and customer premises survey. It primarily is an "insurance" type of survey to check larger buildings where large groups of people assemble such as schools, churches, hospitals, libraries, theatres, hotels, factories, apartment houses, large business establishments, etc.

SPECIAL INVESTIGATIONS

Special surveys normally concern main and service condition and special hazard control. At frequent intervals city, county, state, and federal governments plan and let contracts for various types of construction projects that involve underground utilities. Where new road surface is to be placed over gas mains and services it may be necessary to determine the condition of the gas facilities. Condition surveys are scheduled to determine if such mains and services should be renewed prior to the resurfacing project.

"Hot spots" in a gas distribution system may require frequent appraisal because of rapidly developing leakage due to electrolysis or corrosion. Special surveys can be useful to check the effectiveness of cathodic protection applied in special situations.

As system loads grow due to increased heating demands it sometimes becomes necessary to convert certain sections of the distribution system to higher pressures. In these cases special surveys are required to observe the condition of the system before and after the conversion.

Special surveys may be scheduled following natural and man-made disasters such as earthquakes and explosions. These serve to determine the extent of damage to underground systems, and whether gas leakage contributed to the damage.

Special investigations also may be made as insurance against disaster ahead of events such as street fairs, parades, festivals and other special events where large groups of people will be assembled in areas served by gas.

NEW SURVEY TECHNIQUES

In recent years electronic gas analyzers have gained prominence as gas detection instruments. Regardless of the analyzer used, the analysis can be no better than the sample used in the analysis. These instruments have a place in special investigation applications and in time may become standard for leak detection work.

Probably the most widely used new instrument is the mobile infrared analyzer *(Fig. 1)*. This device is capable of detecting 5 parts per million of methane in air. In addition to sensitivity the infra-red method provides a rapid economical survey method capable of an inspection rate of 15 miles of main per day. There are limitations to the method which seem to indicate that it cannot replace standard survey methods. It probably should be used in addition to regular survey procedures.

A second electronic analyzer is the chromatograph. In a metropolitan complex there are many sources of explosive products which may be present in manhole and other confined atmospheres. Some of these are:

(a) Sewer gas resulting from decomposition and fermentation of organic matter and growths in sewage system.

(b) Industrial waste products such as gasoline, solvents, and other chemicals discharged into drainage systems.

(c) Leakage of petroleum products from storage containers.

(d) Hydrocarbon vapors produced by destructive distillation of insulating material under electric arcs, etc.

(e) Refrigerant escapement from cooling systems.

(f) Marsh gas seepage from decomposed organic materials in original swamp areas which have been filled by urban development.

These complicating factors in leakage detection confuse responsibility where a combustible atmosphere is located. The usual burden of proof on the gas utility is that such vapors are natural gas unless proven otherwise. The gas chromatograph makes it possible to distinguish between natural gas and other gases commonly found in the soil. It can detect components to within 200 parts per million in air accuracy.

In addition to these instruments, research is progressing on a sonic detection device which will detect at the ground surface above the pipe a low energy coded signal impressed in the gas stream at a central point.

INVESTIGATION FREQUENCY

The frequency of leakage investigation is dependent upon the condition of the system, soil environment, age of the system, system operating pressures, past leakage history, population density and other operating features. The minimum inspection program recommended by the ASA Code for Pressure Piping is as follows:

(1) A gas detector survey in business districts at least once a year.

TABLE 2

Frost Susceptible Soils

Group	Description
F1	Gravelly soils containing between 3 and 20% finer than 0.02 mm, by weight.
F2	Sands containing between 3 and 15% finer than 0.02 mm, by weight.
F3	(2) Gravelly soils containing more than 20% finer than 0.02 mm, by weight, and sands, except fine silty sands, containing more than 15% finer than 0.02 mm, by weight. (b) Clays with plasticity indices of more than 12, except varied clays existing with uniform conditions.
F4	(a) All silts including sandy silts. (b) Fine silty sands containing more than 15% finer than 2 mm, by weight. (c) Lean clays with plasticity indices of less than 12. (d) Varied clays with nonuniform subgrade.

(From "Public Works," March 1961)

(2) One or more types of survey outside the business area as frequently as experience indicates necessary, but not less than once every five years.

It is evident that no universal schedule can apply to all companies, since inspections must be tailored to meet local conditions. It also is obvious that more care is due congested populated areas where hazard control is the most difficult and large numbers of the public are exposed to possible dangers. The trend in civic planning and increasing interest in urban renewal is toward the installation of more and more utility structures below ground. The result is continuous construction, greater congestion and increased possibility of damage to utility property. The leakage of gas in such areas presents challenging hazard situations due to numerous conduits leading into buildings which make excellent routes for gas to traverse. Innumerable manholes, sewer lines, etc., provide areas where gas can channel and collect and provide possible hazard points for explosions, any of which could result in a major catastrophe. Gas detector and public building surveys should be scheduled at time cycles which are realistic in relation to the risk. One large municipal utility inspects street openings every six weeks, several other companies make these inspections at six-month intervals. A New York State company inspects public buildings every four months, whereas a large western company checks such buildings every two and a half years.

Naturally, location of leakage is only the beginning, since the company objective is to eliminate possible hazards. Probably the gravest responsibility rests upon the superintendent or supervisor who must classify and schedule leakage repair work. It is an easy matter for a manager to establish a program or policy which states that all hazardous leaks shall be repaired, but the sorting and decision making, in deciding whether a specific leak should be deferred for regular maintenance repair or scheduled for an emergency crew, provides the elements for many nights of insomnia.

Any leakage inspection program should not end with the writing of a repair order. An essential part of the program is a check back after repairs have been made to insure that the hazard actually has been eliminated. The fact that a leak has been repaired does not necessarily mean that the hazard has been eliminated if another leak exists 2 ft. away on the same pipe, if there is a leaking coupling on a second main in the same street, or if gas has channeled along a telephone conduit from a leaking service line a block away.

DAMAGE DUE TO OUTSIDE FORCES

Some 46.2 per cent of the excess liability losses reported by the Indemnity Insurance Co. of North America resulted from gas line breaks due to earth movements or damage from operations of contractors. The major number of breaks due to earth movements resulted from frost heaving. The mechanics of frost heaving are complex and a true frost heave cannot occur without the presence of the following factors: (1) soil susceptible to frost, (2) slowly depressed air temperatures, (3) a supply of water.

When water freezes it expands by about 9 per cent of its original volume. If heat is removed from a frost susceptible soil *(Table 2)*, cooling of the water in pore spaces results until freezing takes place. The water in some cases may be super-cooled and remain as a liquid well below the freezing point. This water will be drawn to the ice crystals through capillary action until ice lenses form and frost heaving results.

Frost action can be correlated with air temperature. Heat is transmitted from the soil through pavement or other surface material to the atmosphere. Penetration of frost under paved streets is deeper than under snow-covered parking strips since grass or snow acts as an insulating barrier to the soil. Thus in extreme cold climates frost depth is much greater under streets than other portions of the right-of-way. A marked variation in frost penetration coupled with heaving can create shearing forces on gas mains. The frost also acts as a sealant, making leakage detection difficult and hazards from gas traveling greater. In areas where frost-susceptible soils are present and cold temperatures prevail, inspection schedules should be varied depending upon season and those locations where gas line breaks due to earth movement might be expected to occur.

The price of progress in a modern complex civilization is continuous construction and excavation in congested metropolitan areas. Exposure of gas distribution facilities to contractors installing other utilities will be accelerated in coming years due to increased urban renewal, public works and highway construction. Excavations by others often encounters gas lines, and even if their location is known, workmen may damage the pipe or protective coating without reporting to the company. Some states have enacted legislation requiring notice of the intention to do work in the vicinity of gas facilities. To date, however, these measures have not become the solution since many contractors display a complete disregard for the potential hazards. The individual utility is faced with a continuous educational and inspection program to develop contractor cooperation and checks to insure that hazards do not develop as a result of third-party negligence.

CONCLUSION

An adequate maintenance program is not an obscure group of ideas carried around in the heads of a manager or superintendent. It has specific objectives which recognize the areas of hazard prevention and sets forth detailed procedures for the detection and elimination of potential accidents. Such a program is substantiated by an adequate record system which provides facts for decision making. The program is an active phase of long-range planning and day-to-day operations of the distribution utility.

A recognition of the legal responsibilities, safety, insurance requirements and hazard control all are factors in the management objective of perpetuation of the business, minimizing losses, and maximizing profits. They also are related to realistic maintenance since they determine most of the basic requirements for the program. ■

(Part 3 next month)

How natural gas came to the birthplace of the gas dishwasher

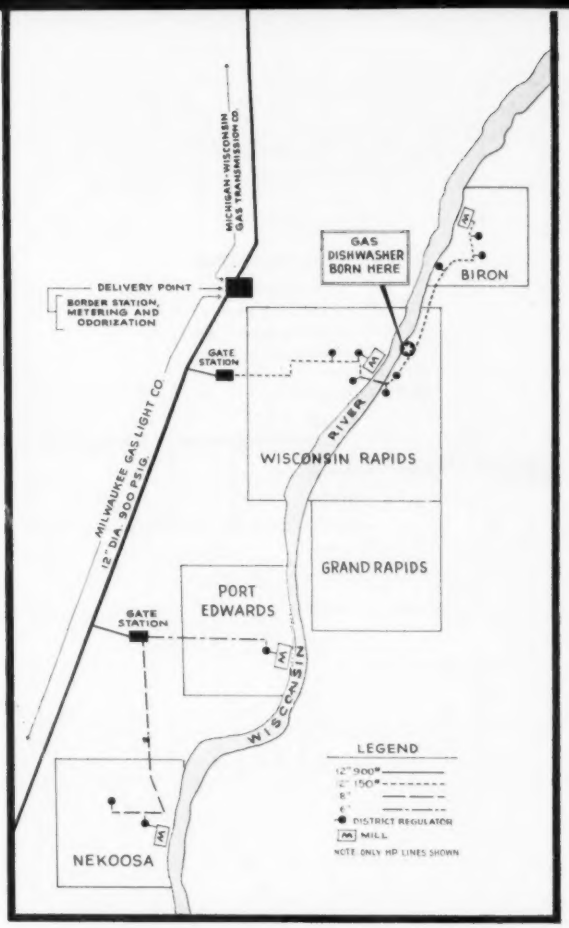


Fig. 1. Prior to the birth of the gas dishwasher, Wisconsin Rapids—and its neighboring towns in the middle of the Wisconsin paper belt—were more famous for their paper mills. Here's how the five towns and four mills now receive natural gas.

FOR a generation or more, young visitors have left Wisconsin Rapids wearing souvenir T-shirts which proudly proclaimed they had visited "The Heart of Wisconsin." Their parents have left with a different kind of memory—of the not really unpleasant, somewhat ham-like aroma of paper mills.

Wisconsin Rapids is a paper town, not only in the center of the state, but right about in the middle of the state's north-to-south paper belt, a string of towns on the banks of the Wisconsin river. Cheap hydroelectric power and a plentiful, handy supply of timber were the reasons for the paper belt. And an assortment of small to large glacier-deposited rocks created the rapids that gave the town its name. While the economy of Wisconsin Rapids has been closely tied to its big paper mill for nearly 125 years, there are other industrial operations.

Most noteworthy of these—particularly to the gas industry—is Preway Inc., the veteran appliance manufacturer and the corporate father of the gas dishwasher

Yet, the fact is that natural gas did not come to the birthplace of the gas dishwasher until late last year. Its arrival was made possible by the meeting of the Midwestern Gas Transmission Co. and Michigan Wisconsin Pipe Line Co. 24-in. mainlines at nearby Marshfield. Together, these two lines supply Canadian gas to the Chicago area and a few points (all in Wisconsin) between.

Actually, Wisconsin Rapids and the four other paper towns in the immediate service area, Biron, Grand Rapids, Nekoosa, and Port Edwards, have been enjoying gas service since 1933. A good percentage of the total population (25,000) was served either by a number of undiluted propane-vapor block systems or by individual LPG cylinders and tanks.

A Minneapolis banker, Lee H. Barker, noted the growth in the propane industry during the depression years and purchased a franchise to serve Wisconsin Rapids. Barker assembled a crew under the direction of experienced gasman Jack Peters, and installed a main to serve his first dozen customers. They had only five days to construct the line, because the franchise was about to lapse when acquired by Barker's newly formed Wisconsin Rapids Gas & Electric Co.

Mains were later installed in the surrounding area, bringing the system up to a total of 5 miles, split into two operating units. The major portion consisted of 7000 ft of 2.0-in. and 1.25-in. pipe that served the commercial and business area from large storage tanks at a pressure of 3 psig.

In addition, 15 other independent tank and main systems were scattered throughout the area. Each served a two- to three-block area. The 500- to 1000-gal. tanks buried on street corners fed mains running behind the curb at 11 in. w.c.

The tanks were filled at regular intervals by a fleet of bulk trucks. The systems proved initially popular

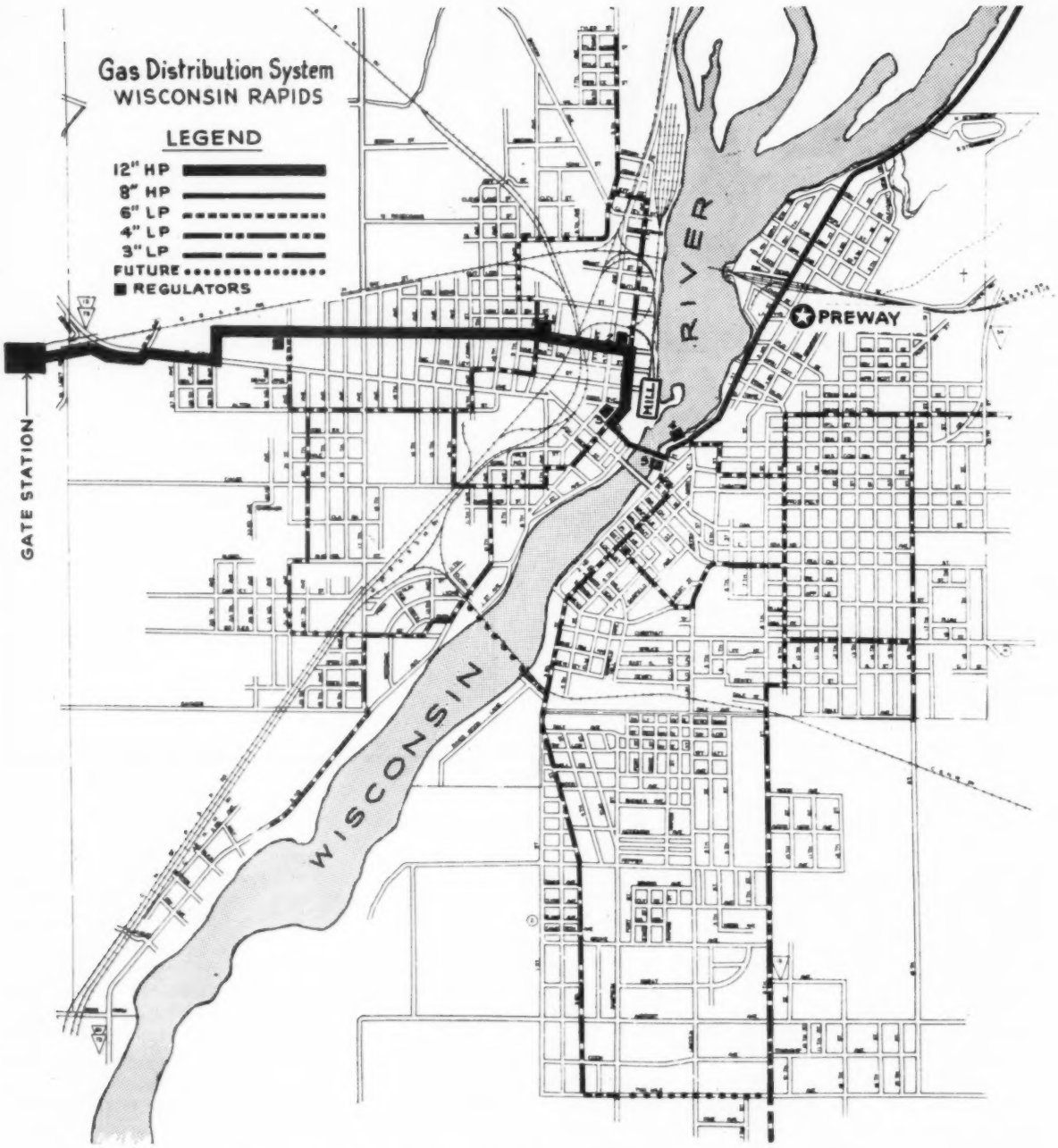


Fig. 2. This map of Wisconsin Rapids shows the basic mains network, both high and low pressure, plus regulator stations, and the city gate station.

because they eliminated unsightly cylinders and provided trouble-free service. All that was exposed on the corner tank was a foot-high protective cap containing the filling cap, pressure relieving device, regulator, and a check valve to shut off the flow in the event of main breakage.

The underground propane distribution system experienced only limited growth—as it became evident that individual cylinders for each residence were more economical. Mains in existence were maintained and a few small systems were added at customer request, but all other new customers were served with individual tanks or cylinders. An extensive dealer system was developed to reach customers in the five-town area. Annual volume exceeded 5 million gal. when natural gas entered the scene.

When construction of the natural gas system began in July 1960, some 130 customers were supplied by propane main systems in Wisconsin Rapids, Nekoosa, and Port Edwards. Within the area, another 1000 customers were served from aboveground tanks.

In constructing the original system, both copper and unwrapped steel pipe had been used and no insulation provided between mains and services of dissimilar materials. Even though the system was without cathodic protection, it had a relatively leak-free

history, largely due to high soil resistivity.

Discussion of bringing natural gas to Wisconsin Rapids began in 1952, but it was seven more years before a final decision was made. Eventual approval, contingent upon export permission from the Canadian Energy Board, was gained in 1959. Thirteen miles of 6-in. line were to bring the gas south from the Marshfield interconnection.

Milwaukee gas Light Co. acquired the Barker interests in October 1960. Barker announced at the time that he had sold three propane companies, City Gas Service Inc., Wisconsin Rapids Gas & Electric Co., and Wisconsin Rapids City Gas Co., for $1.64 million.

With the impending arrival of natural gas, preparations were begun for the distribution system for the five closely linked communities. An analysis of the area and its present and potential loads was the first step. New or replacement main installed for propane service was coated and wrapped from that time on—so it could be incorporated into the new natural gas system.

The old propane system was regarded as inadequate for natural gas, so a decision was made to mark and abandon it. Wisconsin Rapids was surveyed with a Fisher "M-Scope" to locate the old system. Otherwise, its shallow depth, 1 to 2 ft, presented a danger to construction equipment if not properly marked.

An odorization station was constructed northwest of Wisconsin Rapids to serve the entire five-community complex. Adjacent to the "Mich-Wish" meter building, the single odorizing point is a substantial saving over a multi-station odorizing system. The odorizer was built to operate at pipeline pressure. Recent surveys have demonstrated that malodorant is as easily detected at far points of the distribution system as it is at points nearest the station. A 2000-gal. odorant tank serves the entire district's needs.

After being metered and odorized, natural gas is carried south in a 12-in. line for approximately 10 miles. Two regulator stations are constructed along the line to serve communities to the east. (See *Fig. 1.*) The first station, west of Wisconsin Rapids, reduces gas pressures to 150 psig to serve that community.

The Wisconsin Rapids distribution system is divided into eastern and western sections by the Wisconsin river. The only major link in the propane system to be retained is an 8-in. line across the river. Designed as a part of the propane system, but to natural gas specifications, it was constructed on a vehicular bridge. A pressure test insured its adaptability to natural gas distribution.

A map of the Wisconsin Rapids-Grand Rapids service area (*Fig. 2*) shows the 150-psig feeder system, the district regulators, and a skeleton of the primary mains (6-in. and 4-in.) within the 60-psig main system. This feeder-main system was designed to serve the potential high load in the area.

Five district regulators within Wisconsin Rapids produce a dependable supply. Dotted lines on *Fig. 2* show how the system can be improved in both supply and dependability by constructing tie-ins between the initially built portions of the system.

The west side is fed by three regulators which reduce pressures to 50 psig. No mains larger than 4-in. were required because the 12-in. high-pressure line

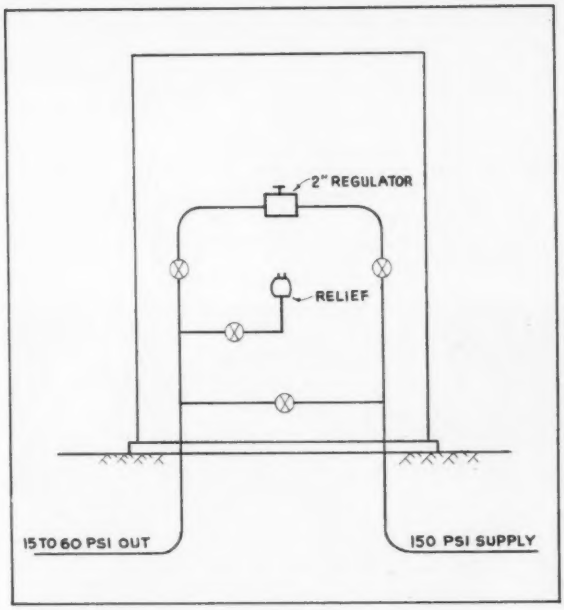
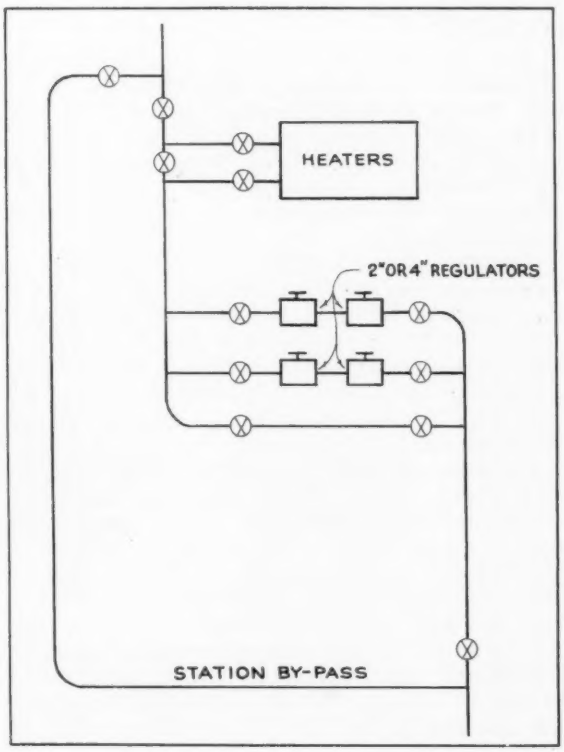
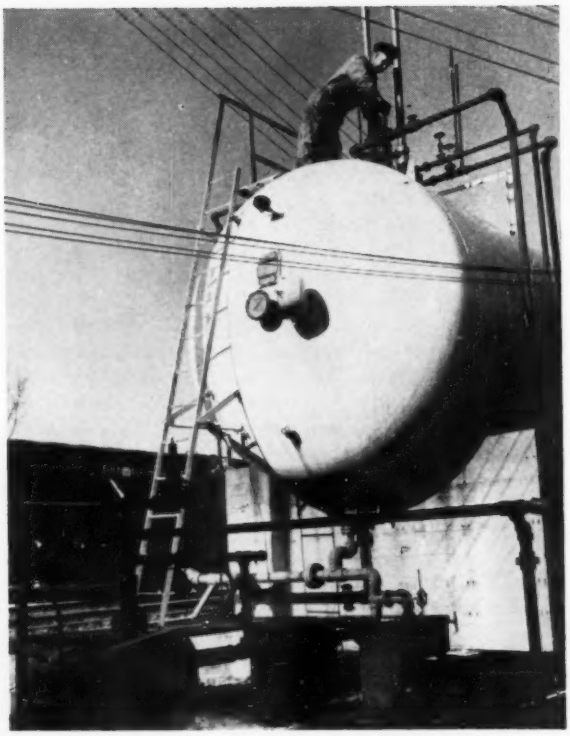


Fig. 3. All district regulator stations were constructed above ground for economy and ease in servicing.

Fig. 4. Because extreme flexibility was needed, gate stations use four regulators in a parallel monitoring system.



Before natural gas arrived, there were 15 residential block systems, each serving two or three city blocks and each fed from an underground propane tank buried on a corner. Here, the delivery man had an easy time of it, as that light snow on the ground definitely is not typical of Wisconsin Rapids winters.



And also before natural gas arrived, ▲ the downtown area was fed undiluted propane vapors from 18,000- to 30,000-gal. bulk tanks such as this one. However, almost the entire underground system was abandoned when natural gas arrived.

could be tapped by additional regulators to build up the supply.

Two regulators serve the east side of the river. With the major industries located there, the system was planned to feed these plants via high-pressure mains. All regulators (*Fig. 3*) were constructed above ground for economy and ease of servicing. The eastern system also supplies gas service for Grand Rapids, to the south and Biron, to the north. Biron has three regulator stations.

The 12-in. line running south from the Wisconsin Rapids regulator station continues past the western city limits to the Port Edwards regulator station where it ends. Here again, pressure is reduced to 150 psig to supply Port Edwards and Nekoosa. One regulator is sufficient for Port Edwards, but two are needed for Nekoosa because a large rail yard divides the town.

The initial operation of almost any new natural gas system presents some operational problems in pressure regulation and odorization because of small initial flows. This problem was compounded considerably in the Wisconsin Rapids area. The city gate station for Wisconsin Rapids had to be designed to a 2-MMcfh capacity. The initial flow through the station two months after it went into operation averaged 25 MMcfh and under extreme low-load conditions, was as little as 5 Mcfh. The gate station supplying Port Edwards and Nekoosa has a design maximum load in excess of 1 MMcfh, but the initial load was approximately 2 Mcfh. Thus it was necessary to install gate station regulators with a range of approximately 400 to 1.

For flexibility, each station has four regulators in a parallel monitoring system. A schematic of the gate station design (*Fig. 4*) shows the design utilized for both stations. The only difference is the size and capacity of the installed facilities. The Port Edwards station contains four 2-in. regulators, the Wisconsin Rapids station, four 4-in. regulators.

The regulators are designed for an input of 1000 psig, and can be equipped with springs of various ranges to provide outlets from 40 to 400 psig. Because of initially low flow, some difficulty in regulator freeze-up was incurred in spite of the gas being heated. Installation of a drip-tank alcohol injector completely eliminated regulator freeze-ups.

Conversion of customer appliances was less of a problem than it would normally be. Because the existing propane system was almost completely abandoned, almost all customer piping was renewed during the conversion program. It was thus possible to complete all natural gas main and customer piping without interfering with the operating propane system. The

result was better conversion scheduling.

Once the old customers were converted, work went rapidly ahead on taking care of new ones. The company reports it has been laying pipe at a million-feet-per-year clip, now has over 100 miles of main in the Wisconsin Rapids area.

Industry presents the greatest load potential in the area. Preway, of course, was among the first to request natural gas service. Also on the lines are four of the nation's biggest paper mills, a pair of foundries, and—among other things—an infra-red-heated hangar at the local airport. Perhaps that doesn't sound like too much, but this "little" industrial load is equal to 18 per cent of Milwaukee Gas Light's total '60 send-out!

The future looks even brighter, according to the local Chamber of Commerce. A new bridge across the river and an industrial park are expected to greatly spur local industry.

The local commercial market is already captured—99 per cent of the restaurants in the areas are on gas.

The residential market, however, still has a tremendous amount of potential. Domestic customers now total 1400. Gas appliance sales have risen appreciably since natural gas arrived. Estimates are that natural gas will supply 4500 of the 7000 homes predicted for the area by 1966.

The man who most hopes all these predictions come true is James Booksh, Jr., general manager of Milwaukee Gas Light's western division. Booksh joined Milwaukee Gas Light early this year. In the gas industry since 1947, he spent 10 years with United Gas Corp., then joined Rockwell Manufacturing Co. to assist in preparations for bringing natural gas to Florida. Later—as a member of the consulting firm of Reynolds, Smith and Hills—he was in charge of design and field work on the construction and operation of five natural gas distribution systems. Booksh headquarters in Wisconsin Rapids.

At the same downtown location, just off the main street, is the division's operations center, including its business office, warehouse, and repair shop.

Supervising the operation's 30 employees—and reporting to Booksh—is District Manager Miles Barker. Heading facets of the operation are: Operations Superintendent Edward Beardsley, Construction Engineer J. Roger Miller, Sales Manager Donald Putnam, Customer Service Coordinator Charles Disert, and Office Manager Helen Mullen.

And that's how natural gas has come to the birthplace and hometown of the gas dishwasher—and center of one of the greatest paper making areas in the world. It's only fitting that the gas dishwasher should be produced with natural gas. It would tie up this story neatly to be able to say that the paper on which it appears was produced in Wisconsin Rapids, with the aid of the gas system you've been reading about, but we're reasonably certain it wasn't—since the publishers of *GAS* own their own paper mill. However, the chances are fantastically good that sometime during the next day or so you will handle paper produced in the Wisconsin Rapids area. And this will probably continue to happen every day or so for the rest of your life—thanks, in part, to natural gas. ■

Conversion work was both easy and hard. It was easy because all workmen could install the complete new system without interfering with the propane system in service, either from one of the block systems, or from the customer's own bulk tank as shown here. It was hard because much of the work was done in frozen ground and air hammers were required, again as shown here.

Cascade's road to success:

Unique dealer relations program

By R. M. Austin

RESULTS of a unique dealer relations program are the major factor contributing to the recent advances made by Cascade Natural Gas Corp. O. Marshall Jones, president of the four-year-old Seattle utility, says the program significantly increased the number of customers on existing mains while raising the average load per customer.

Cascade's net income of $603,287 for 1960 represented an increase of almost 250 per cent over the previous year. Jones said this exceptionally high rate of growth demonstrates the benefits of a program adopted in 1958. Its aim: Increase the utility's effective sales force from 30 to over 300 people without any investment in salaries, facilities or inventory.

In reviewing the program for *GAS*, Jones pointed out that the launching of this effort marked the financial turning point for the young Pacific Northwest organization.

One of Cascade's problems is its wide geographical area. It covers Washington state from the Canadian border south to the Columbia river and from the Pacific ocean to eastern Washington, as well as a large part of northeastern Oregon.

While the potential of these locales offered exceptional opportunities, the launching of the new utility was not without a considerable number of difficulties. One of the first obstacles to growth was the delay of several months in the arrival of natural gas in the Northwest during the utility's formative months of 1956. As a result, a considerable reduction in revenues anticipated for the first year of operation occurred because domestic and small commercial customers had already determined their winter fuel plans by the time gas arrived.

Furthermore, construction costs exceeded original estimates in many cases. For example, the relocation of Pacific Northwest Pipeline Corp.'s mainline* required the extension of connection laterals beyond the lengths first specified. In other areas, the final position of the line required laterals longer than originally planned. In a number of cases, the increased load requirements for industrial installations made it necessary to use larger pipe than originally planned.

* Now a unit of El Paso Natural Gas Co.

LEFT: Cascade president Jones discusses future plans with his staff. Seated, from left: Edward Niederer, Jr., vice president, operations; R. J. Garrett, residential sales manager; A. R. Mitchell, treasurer; Jones; Martin Ford, assistant to the president. Standing, from left: W. E. Wall, attorney and secretary; W. R. Piatt, superintendent of construction; C. Spencer Clark, board chairman; and Lester W. Pettit, executive committee chairman. ABOVE LEFT: L. N. McGuire of the U. S. Bureau of Mines conducts a demonstration of natural gas properties before 350 guests assembled for the second annual independent gas appliance dealers and installers convention in Seattle.

The result, not uncommon to a new utility being launched in a virgin territory, was a net loss of $536,-884.62 in the first year of operation.

In the following year, Cascade doubled its revenues while reducing operating expenses to some degree. But new complications arose. The Pacific Northwest experienced the warmest winter on record, reducing anticipated space heating revenues considerably. Also, the number of domestic customers converting to natural gas fell below original estimates. Result: Cascade ended 1957 with a net loss of over $1.2 million.

This was the picture when Jones took office as president in January 1958. Analyzing the situation, he concluded the only solution to the company's financial dilemma was to adopt the following four-point program:

1. Build load through increased saturation of existing facilities.
2. Build load by upgrading present customer usage.
3. Economy of operation.
4. Conservation of cash resources.

Taking quick and positive action, Jones ordered immediate cessation of all main construction for an unspecified period. Then, he went before the Public Service Commissions of both Washington and Oregon to acquaint these groups with the need for such a move.

"I explained the situation and said we just couldn't build any more mains until our house was in order," he said. "Both of these agencies were very understanding and gave us full cooperation, with the result that we were able to retain their confidence."

With this drain on the company's resources eliminated, Jones turned to the problem of increasing revenues. Reduced to essentials, this meant not only getting more customers on existing mains, but getting them to use more natural gas through more appliances.

The answer was an expanded sales force and a vigorous promotion. But a quick look at Cascade's extensive service area revealed that the utility's 30 salesmen were far too few to handle a regional sales effort of the scope required. Furthermore, a newspaper advertising program for such a promotion would require at least a 40-paper schedule to cover all of Cascade's service area, a cost factor which was far too large to be considered at that time.

The best means, Jones concluded, would be to utilize the merchandising abilities of the many retail outlets in those areas of Washington and Oregon where Cascade wanted to do an effective job of selling natural gas.

"Such a program would require that we have the full confidence of the individual dealers," Jones said. "Therefore, our first move was to advise all dealers that we were getting out of the appliance business completely, an announcement that was greeted with surprise, applause and even scepticism in some quarters."

Following this announcement, Cascade launched a dealer relations program designed to turn the sales force of every appliance store into salesmen for natural gas. The heart of this program is a commission plan which makes payments directly to all salespeople who consummate a gas appliance sale. Based on a sliding scale, these commissions not only encourage salespeople to place first emphasis on gas appliances. They also offer an additional incentive by making the payment for a double sale even greater than that for selling two appliances at different times.

To inaugurate this program, Jones used funds originally earmarked for advertising. In this manner the company could realize positive results for each dollar spent, a matter of extremely vital importance at the time. As the program got underway, the president said, even those retailers who first expressed some doubt as to Cascade's intentions of remaining out of the appliance business realized the sincerity of this intention and willingly signified their desire to cooperate in the program.

With the program established, Cascade moved to cement relations with the dealers by initiating an annual clinic for retailers. Known as the Annual Independent Gas Appliance Dealers & Installers Sales Convention, this two-day event is devoted to a program of merchandising techniques, new equipment and appliances and demonstrations which not only assist the dealers to do a better selling job for themselves and natural gas, but also strengthens their bond with Cascade.

In addition to the retailers attending the conference, Jones personally invites city officials in those communities which comprise Cascade's service area. Mayors, city managers, fire chiefs, fire inspectors and other representatives of these cities and towns gain a new understanding of the characteristics of natural gas at the convention. This is an important factor, as little is known of natural gas in many areas and in others it is completely new. Furthermore, this event permits the utility to demonstrate its progress of the past several years, an excellent public relations effort which greatly strengthens public confidence.

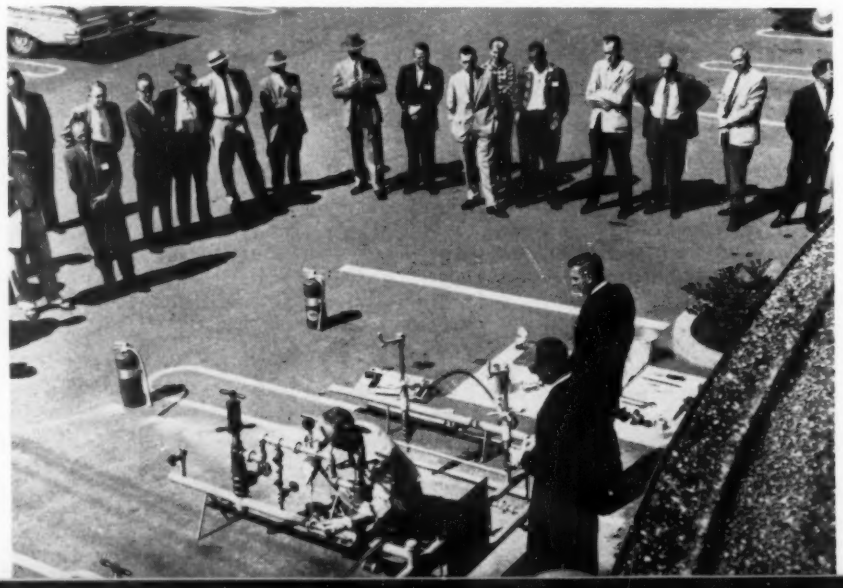
Attendance is by invitation and Cascade pays all expenses, including transportation, for the more than 350 guests. The positive results of the convention on behalf of increased natural gas sales was acknowledged by the American Gas Association in 1959 when Cascade received a Public Relations Award for its efforts in sponsoring the event. Cascade also holds four district meetings a year so that dealers can be kept abreast of new merchandising techniques and appliances.

The results of Cascade's new dealer program were noted only several months after it was launched in 1958. The beneficial returns increased in volume quite rapidly, and for the fourth quarter of that year the company reported a profit, the first in its history. While the annual report showed a loss of $96,728 for the year, the greatly increased revenue of the final three months not only indicated a new trend, but the value of the dealer program, as well.

The increasing effectiveness of the dealers' salespeople was displayed in 1959 when Cascade achieved its first annual profit—a highly impressive sum of $200,000—and gas operating revenues climbed to near the $7 million mark. The rapidly improving financial situation, made possible by the dealer program, also enabled Cascade to begin limited expansion of its facilities by running service lines from existing mains in a number of areas.

By the end of 1960, Cascade found its dealer program had boosted the number of residential customers by 50 per cent and more than doubled domestic sales in terms of both revenue and therms. With the experience gained during the previous two years, Cascade was quick to adopt a similar program when it acquired the Pacific Natural Gas Co. of Longview, Wash., in September, 1960. Jones reports the dealer program in this area resulted in an average of 15 new customers each week.

The bright financial picture which now characterizes the Seattle gas utility has not only enabled it to acquire Pacific Natural Gas—now an operating subsidiary—but made it possible for $2.2 million to be spent on new construction during 1960. A total of $2,750,000 was allocated for construction during the present year, which will see natural gas arriving in



City officials from many communities in Cascade's service area witness a special demonstration of safe practices in tapping mains. Vice President Niederer conducted the demonstrations to acquaint the officials with the characteristics of natural gas.

the communities of Lynden, Nooksack and Everson, north of Seattle. In southwestern Washington, Cascade will also bring a line into Kalama this year to serve both domestic and industrial customers, the most important of the latter being Dow Chemical Co.'s new plant.

Furthermore, in February of this year, Cascade made another acquisition, that of the municipal gas distribution system of the City of Moses Lake, Wash. Another factor which contributes to the bright outlook for the young corporation is the fact that Cascade is getting about 95 per cent of the new construction business in those areas near its mains.

Today, Cascade conducts a continual and well-integrated promotional effort designed to support the dealer program and keep it operating at a high degree of efficiency. A concentrated direct mail program tailored to the needs of local retailers seeking increased gas appliance sales is made available to all dealers working with Cascade. Another service to dealers is the arrangement whereby Cascade gives the name of each new customer to retailers in the immediate area, thereby increasing the sales potential for both the local store and the utility. In addition, Cascade also participates in cooperative advertising for a variety of media, including daily and weekly newspapers, radio and television. For dealers who wish to conduct their own mailing effort, Cascade furnishes a list of their customers in the store's area.

Another effort by Cascade to increase both the number of customers and the domestic load is the "Home Gas Heating Plan" for residences which have service but are not using it for space heating. Under this arrangement, Cascade places a conversion burner in any convertible furnace at no cost to the householder. Then, for an annual service charge of $16—payable at the rate of $2 per month for eight months—the utility guarantees to maintain the furnace without any further charges.

Purpose of this plan is to make customers out of the 10,000 to 15,000 people who have service to their homes but haven't utilized it. So far this year, 1400 homes have been converted to natural gas and Cascade hopes to obtain 5000 before the end of the year. If a home doesn't have a natural gas service line, it cannot qualify under the plan, even if the owner requests a service for this purpose. However, if a customer first purchases a gas appliance from a dealer and requests a service line, he is eligible.

Looking into the future, Jones foresees substantial growth for Cascade during the next several years which should be equal to or even greater than the increase of 1960 over 1959. A major portion of such an increase will be the result of natural gas arriving at the Grays Harbor area of western Washington in 1962 and the growing industrial area of eastern Washington in 1963.

In describing the extremely rapid progress which Cascade has made in consolidating its financial position and preparing for the future, Jones pointed out that the dealer program should receive the bulk of the credit. Furthermore, he said, all future expansions will feature a concentrated program of this type to assure a continuing growth of both customers and domestic loads.

"We are most certainly going to continue this program on a permanent basis," Jones said emphatically. "This decision is based not only on the results to date, but economics, as well. If Cascade had to do its own merchandising in all parts of the service area, we would have it maintain 42 display areas, staff each of them with sales personnel and stock a tremendous inventory of gas appliances, all of which would involve an investment of considerable proportions. But with our dealer program, all of this overhead is removed and the selling job is still accomplished in a very effective manner," he said.

Another factor which has played a part in Jones' decision to get out of and stay out of the appliance business is that of specialization.

"We are specialists in natural gas distribution, not appliance sales," he said. "Therefore, it seems to me that the latter function should remain in the hands of men who devote their full efforts to this field."

Summarizing his thoughts on this matter with a wry grin, Jones pointed to the other side of the coin, saying: "I know we'd be a bit put out if dealers tried to get into the gas distribution business." ■

Demonstration of various types of appliances was held for dealers and installers during the convention so that they could do a better job of merchandising. Here, William Thomas of Norge demonstrates some of the selling points of a gas dryer.

By Irving Deutsch, P.E.

PART 6: Gas utilization

Continued from November GAS

Absorption system, direct fired:
Household refrigerator:

THE small absorption type cooling systems use ammonia as the refrigerant, and are similar to the compression system in that a generator may be thought of as the compression side of the compressor and the absorber may be thought of as the suction side of the compressor.

Fig. 3 shows the simple absorption system in schematic form. *Fig. 4* shows the scheme adapted to a gravity flow system that eliminates need for a pump.

The Electrolux (Platen-Munters Patent) absorption process uses hydrogen to make it possible to have uniform pressures throughout the system so that the ammonia vapor pressure in the condenser is equal to the hydrogen and ammonia vapor pressure in the absorber. To avoid detail in this section, the actual operation is described in the addendum.*

* Copies are available from The Editor, GAS Magazine, 198 S. Alvarado St., Los Angeles 57, Calif.

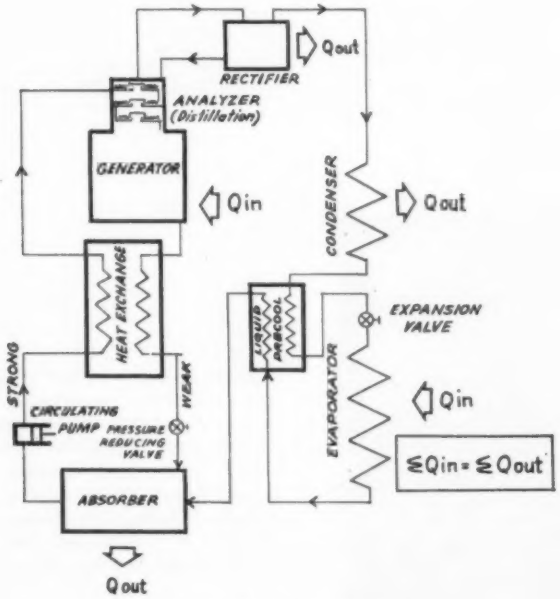


Fig. 3. Simple absorption system.

Absorption system, direct and indirect:
air conditioning

For air conditioning applications it is not necessary to have the low temperatures required in the freezer and refrigeration systems. Hence, it is possible to use an absorption system with water as refrigerant and a harmless salt (such as lithium bromide) as an absorbent. Heat is used to re-activate the sorbent salt. The heat may be supplied by a direct gas flame or indirectly by steam from a boiler that may be used in a heating system, or from waste steam or condenser steam in process work or turbines, respectively. Seasonally idle boilers can cut demand charges by putting them in use throughout the year, thereby minimizing operating costs. One such installation is the 6300-ton unit capable of air conditioning all planned buildings in New York's International Airport.

Comparison of COP

Compression systems operate with a COP of roughly 4 as compared to the absorption cycle COP of roughly 0.5. This explains why some companies lean toward production of compression systems using gas as engine fuel, while others prefer the simpler absorption system that makes it possible to cut fixed charges by using the same unit to heat and cool. Taking into consideration the differential in cost between gas and electricity on the energy basis of approximately 1 to 5, respectively, one can see why refrigeration with gas is competitive. Further, taking into consideration that an internal combustion engine normally operates at about 30 per cent efficiency, one can see that the compression cycle fueling with gas loses what off hand might appear to be an insurmountable advantage. All in all, the selection of a refrigerator or air conditioning unit must be evaluated not only on the basis of COP, but also first cost, cost of fuel or energy, operating and maintenance cost, future expansion, space requirements, year-round climatic conditions, and availability of condenser coolant.

What size?

Refrigerators are usually sold on the basis of cubic feet of storage required. The manufacturer designs the cooling system to suit—no problem here.

Air conditioning units, on the other hand, must be selected on the basis of the heat that must be removed from the space in question. Since the first use of refrigeration was for freezing water to ice, the ton of refrigeration was first utilized. It is the Btu required to remove latent heat of fusion for a ton of ice in 25 hours. On an hourly basis, a ton of refrigeration

(*Continued on page* 80)

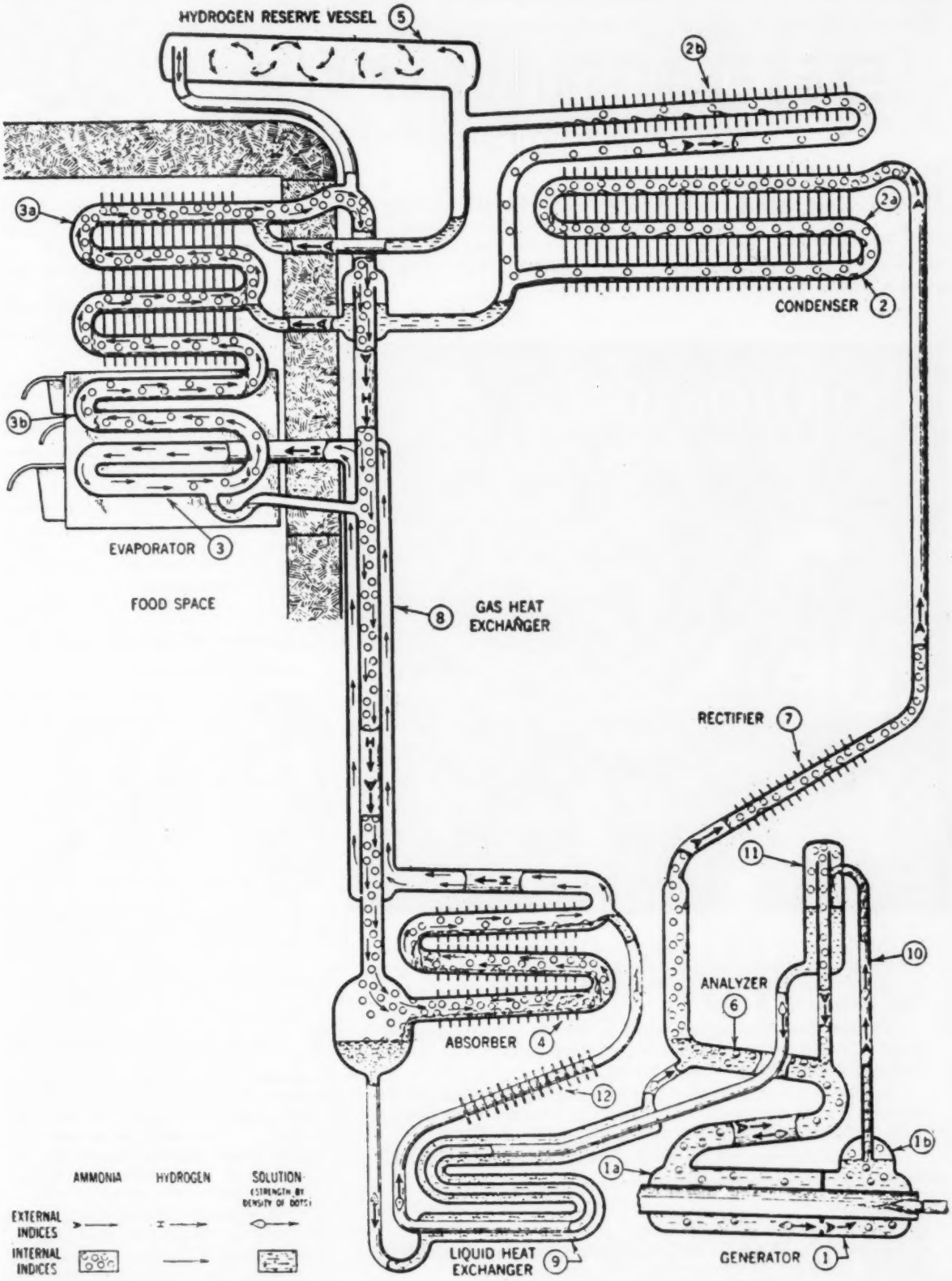


Fig. 4. Simple absorption system adapted to gravity flow system.

GAS DISTRIBUTION NEWS

United wins round in San Antonio fight

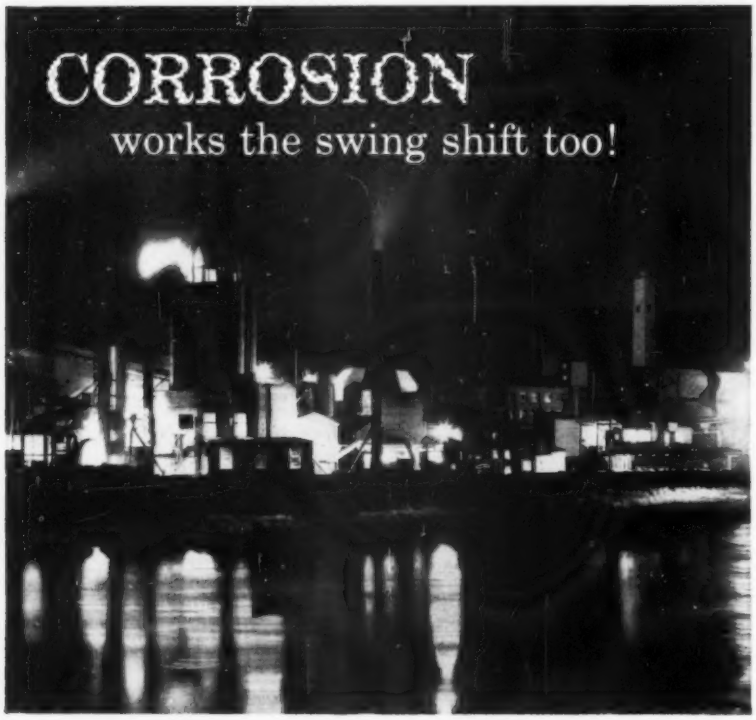
District Judge Jack Roberts overruled a request by the City of San Antonio, its public service board, and Alamo Gas Company Co. to have United Gas Pipe Line Co.'s suit against them tried in San Antonio.

The three gave immediate notice of appeal to the court of civil appeals.

United brought the action to prevent Alamo from supplying San Antonio's gas starting next April.

The controversy in the present ruling involves only where the trial will be held.

Several months ago United asked the Texas Railroad Commission to prevent San Antonio from switching its gas contract to Alamo Gas. When the commission denied that it had jurisdiction, United went to the district court. United, contending that the change is not in the public interest, says it will have to raise its gas prices to other customers if it loses San Antonio.



Thousands of miles of underground pipe feed natural gas to factories . . . other pipelines distribute oil and other petroleum products. And every foot . . . every inch . . . could corrode and leak anytime, day or night.

Electro Rust-Proofing can assist in the big job of corrosion control. Assist with surveys, design recommendations and actual installation of corrosion control systems.

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Honeywell offers control courses

Minneapolis - Honeywell's Philadelphia-based instrumentation education center is expanding its curriculum for 1962.

Two special courses, Control Dynamics and Fundamentals of Instrumentation, are being offered in addition to regular instrument services and maintenance classes.

Control Dynamics is an intensive five-day course for instrument and systems engineers covering nonmathematical techniques for evaluating process dynamics in solving automation control problems. Sessions for 1962 will be held April 9-12 and Oct. 1-15.

Fundamentals of Instrumentation is a 10-day course to be held three times during the year—March 5-16, June 18-29, and Oct. 22-Nov. 2. It is primarily for engineers with little or no instrument experience and for those needing to review the principles of conventional instrumentation.

Enrollment information is available from Clarence A. Dyer, Instrumentation Education Center, Minneapolis - Honeywell Regulator Co., Wayne & Windrim Aves., Philadelphia 44.

Continued on page 73

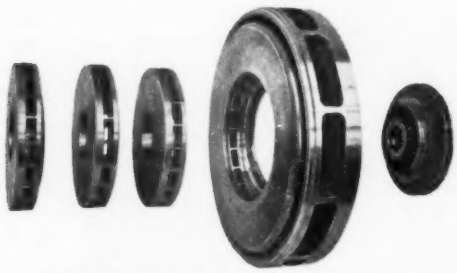
How Solar gas turbine compressor sets with interchangeable stages offer users low cost, versatility

The advent of Solar gas turbine-powered centrifugal compressors is ending the long-time dependence on reciprocating power for the low volume gas compression range under 1600 inlet scfm.

It has long been known that a centrifugal compressor would be less expensive to own and operate in this range if an efficient, long-life driver were available.

The introduction by Solar of an industrial gas turbine driver in the small horsepower range has resulted in a centrifugal compressor unit which has the advantages of low installation and maintenance costs as well as versatility and portability.

Through use of a concept of interchangeable staging, operators of Solar compressor sets have at their fingertips an almost infinite capability to meet changing flows and pressures—within the conditions of 1.15 to 3 ratios, 200 to 2000 hp and 200 to 1600 inlet cfm. This is accomplished by a set of five pre-engineered compressor wheels—A through E—each of which has a choice of three different guide vanes and a diaphragm. By selection of these 25 basic parts—five wheels, fifteen guide vanes, five diaphragms—any flow and pressure in the low volume range can be met quickly and easily.



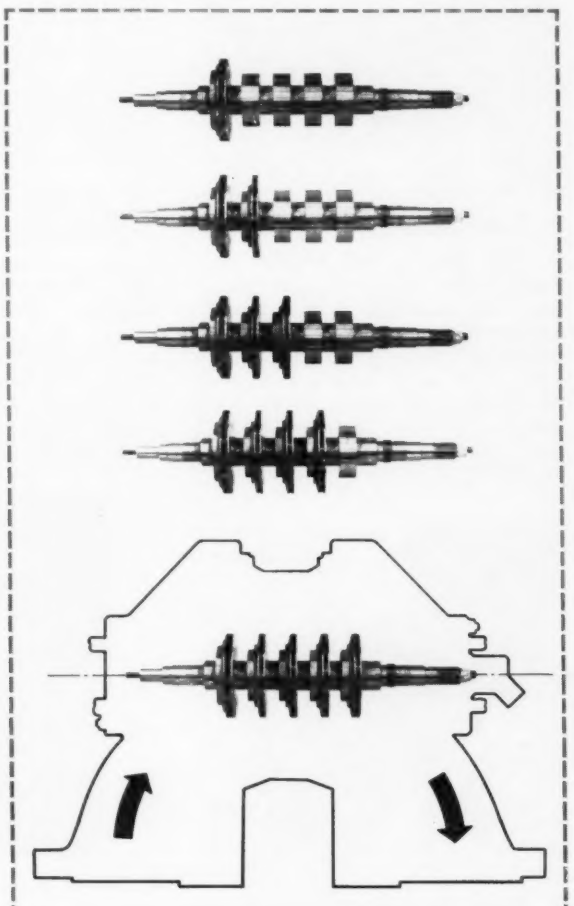
Each of 5 compressor wheels (right) may be used with diaphragm (center) and choice of 3 guide vanes (left) to meet any pressure, flow requirements.

For instance, to meet a certain set of conditions, two "B" wheels and a "C" wheel with specified guide vane configurations might be prescribed. When these conditions change, a new setup requiring one "B" wheel, one "C" wheel and one "D" wheel might be necessary, again with the specified guide vane configurations.

All that is required to meet the change is substitution of new wheels in the same compressor on the same shaft in the same axial space—an operation which can be done easily and quickly on site. And all wheels, guide vanes and diaphragms are available for instant delivery from Solar's pre-engineered, on-the-shelf stock.

Solar 1100 hp *Saturn* turbine-driven compressor sets weigh 15,000 lbs—approximately 1/10th the weight of comparable reciprocating machinery. They occupy less than 300 cubic feet. These factors mean they are less expensive to install and easily portable to a new site for periodic maintenance.

They are currently in service in several pipeline and field boosting applications. For more information, write to Solar, Dept. J-167, San Diego 12, California.



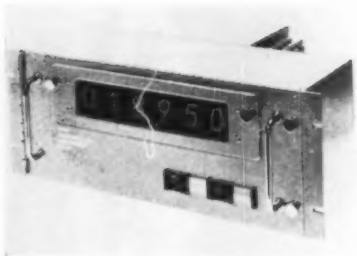
SOLAR

A Subsidiary of International Harvester Company

GAS DIGEST

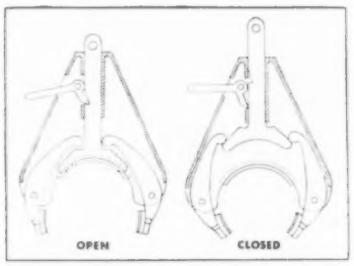
New Products and Trade Literature

For more data on any of these items use the Reader's Service Card on pages 66, 67



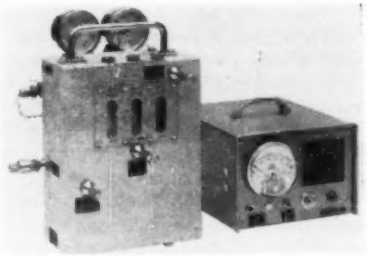
1. Telemetering

Datex has a new digital data transmission system for remote display and recording of information from various types of meters on pipelines. The Datex SD-102 accumulated count data system features error and safety checks, high reliability, easy installation and maintenance.
Datex Corp.



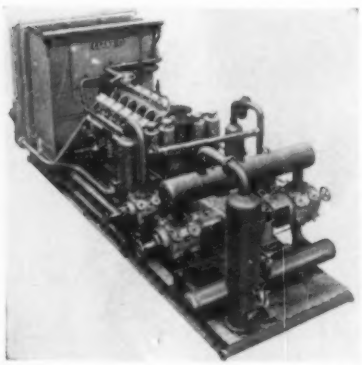
3. Automatic pipe tongs

Pipe is released automatically when weight is slacked off with Mathey's automatic-release pipe tongs. For safer handling, the tongs do not require anyone near to manually release them. They are available in a complete range of standard pipe sizes—3 to 36 in.
C. A. Mathey Machine Works



5. Moisture analyzer

Manufacturers Engineering & Equipment's new electrolytic moisture analyzer, Model W, Type HP, is for accurate high pressure moisture measurements with minimum expansion. The analyzer, which includes components, handles gas input pressures up to 10,000 psig.
Manufacturers Engineering

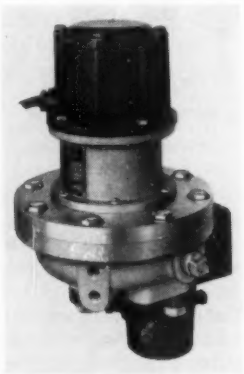


2. Field compressor

New Model CFB-4 extends to 750 bhp the horsepower range of Clark's CFA-CFB packaged field compressor line. It is designed for heavy duty jobs where greater capacity and one to four stages of compression are required. The CFB-4 is built in sizes from 400 to 750 bhp.
Clark Bros. Co.

4. Gas light marker

Arkla has developed a gas-lighted personal marker, the "Hallmark One." The 15 x 8 x 9-in. marker consists of a gas light shining through opal glass panels. It is especially suited for "personalizing" address markers. The light comes equipped with brackets and fittings for mounting.
Arkla Air Conditioning

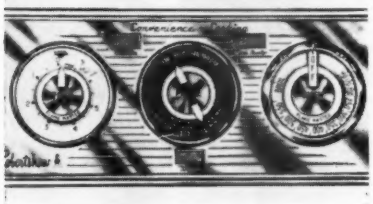


6. Gas density cell

Foxboro's Type 35 gas density cell provides continuous measurement of gas density in lb per cu ft. It produces a differential pressure directly proportional to density which, coupled with a pressure differential across a primary device, makes it possible to determine mass flow of gas.
Foxboro Co.

7. Record gauges

Rockwell has added a temperature recording device to its combined record gauge. The gauge now records changes in gas temperature as well as pressure variations. These combined data provide a basis for calculating corrected volumes of gas metered at pressures and temperatures at variance with predetermined base values.
Rockwell Manufacturing Co.

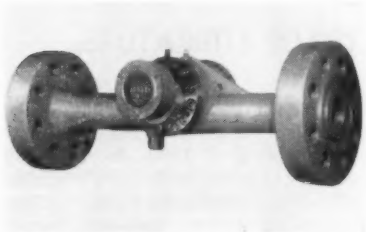


8. Oven time control

Robertshaw has combined its Flame Master gas oven thermostat with an automatic time control. When cooking is completed, the time control automatically reduces the oven from cooking temperature and holds it at a lower serving temperature for several hours if needed.
Robertshaw-Fulton Controls Co.

9. House regulator

Reynolds has developed a bell-crank model of its 8010 series house service regulator. The NRT 8010 incorporates a bell-crank mechanism that includes a hex aluminum slide and bell crank of rust-resistant plated cold-rolled steel. All other features are the same as the toggle-type.
Reynolds Gas Regulator Co.



10. Flowmeter

A 2-in. model Rotron Whirl-Flo flowmeter is designed to provide an economical, accurate means of measuring gas or liquid flow. Pressure rating is 5000 psig. The meter is designed on the vortex-velocity principle of measurement, with an offset chamber in the side of the pipe in which a natural vortex is allowed to develop.
Rotron Manufacturing Co.

Free literature offered by advertisers in this issue

For more information circle numbers 27 through 70 on Readers' Service card

27. Integrating orifice meters are described in American Bulletin 401 (p. 78).

28. Pressure regulators for reducing, relief and back pressure are in Reliance Bulletin 130 (2nd cover)

29. Relief valves for control of overpressures are in Axelson's Bulletin RV (p. 122).

30. Types and sizes of orifice flanges are in Babcock & Wilcox Bulletin TF-507 (p. 42).

31. All-weather digging power of Case 310's is discussed by Dept. M1391 (p. 37).

32. Dead weight testers for line pressures are described by Chandler (p. 84).

33. Packaged orifice meter stations are discussed in Daniel's Bulletin MS-1 (p. 120).

34. Telemetering systems that simplify maintenance are described in Foxboro Bulletin 17-12 (p. 118).

35. Company case histories with rigid plastic pipe are available from Goodrich Dept. NS-6 (p. 34).

36. Case proven examples of Grove Flexflo regulators are presented in Bulletin 800 (p. 39).

37. High capacity rotary positive displacement meters are illustrated in Roots Bulletin M-361 (p. 43).

38. Properties of ABS plastics pipe highlight 20-minute film from Marbon Dept. F-12 (p. 29).

39. Fittings, fabricated piping, etc., from Midwest are in Bulletin 61A (p. 121).

40. Compact compressors are described in White Bulletin 124 (p. 113).

41. Information and specs on making hot taps without valves are available from Mueller (p. 24).

42. Couplings and fittings plus installation hints are in Normac. Bulletin 12 (p. 83).

43. Samples and descriptive data on tin-lined copper tube are offered by Phelps-Dodge (p. 30).

44. Full circle clamp couplings to repair pipe are in Smith-Blair Bulletin 1263 (p. 70).

45. Non-lubricated pressure sealing gate valves are in W-K-M's Bulletin WS1061 (p. 117).

46. Quality control of line pipe is described by Youngstown's Dept. 18-B (p. 96).

47. Qualities of ductile iron pipe are listed in a brochure from McWane (p. 33).

48. Operating details on temperature compensated meters are offered by American Meter (p. 77).

49. Field testing of positive displacement meters is described by American in Bulletins 203.1 and 204 (p. 82).

50. Details on meters for large load requirements are available from Sprague (4th cover).

51. Natural gas engines from 720 hp to 450 kw are described by Caterpillar (p. 38).

52. Details on swivel ells and loops are offered by Production Plating (p. 79).

53. Null-search system of inspecting protective coatings is described in Tinker & Rasor data kit (p. 81).

54. "Pocket Valve Guide" provides specs and coverage charts on Permaturn valves (Nov. p. 17).

55. On-the-job recording of 2-way radio clarity is offered by Motorola (Nov. p. 30).

56. Welded steelcase meters are covered in American Bulletin 304 (Nov. p. 96).

57. Dry centrifugal gas scrubbers are described in Aerotec Bulletin AI-102 (Nov. p. 138).

58. Halfsoles, welding sleeves, concrete PL markers are covered in Allan Edwards catalog (p. 124).

59. Plastic pipe is discussed in Naugatuck's "Gas Installation Handbook" (p. 72).

60. A telemeter receiver—Series 670—is described by Bristol (p. 36).

61. Facts about pipeline corrosion are available from Electro Rustproofing (p. 62).

62. How to take dew point readings with UGC's Dewscope is told in a brochure (p. 100).

63. Information on pipe line products is available from Philip Carey Dept. GA-1261 (p. 125).

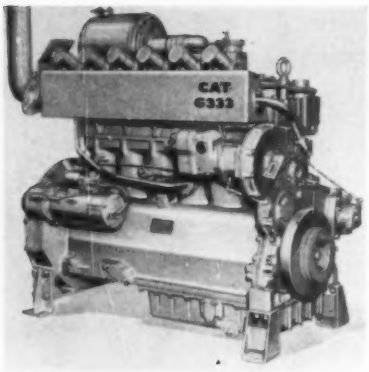
64. Design features of O-ring closures are discussed in a Peerless bulletin (p. 18).

65. Removing oil and casinghead drip with gas scrubbers is covered in Anderson Bulletin 601 (p. 69).

66. Sequencing units, supervisory and computer control are described by North Electric (p. 102).

67. Measurement of fluids—gas or liquid—by mass flowmeter is discussed by Black, Sivalls & Bryson (3rd cover).

68. Rockwell's spherical, full-opening pipeline valves are described in Hypresphere Bulletin V-618 (p. 1).

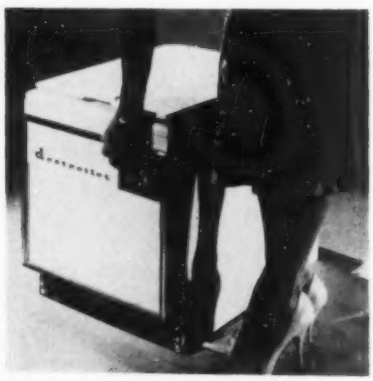


11. Natural gas engine

Caterpillar's latest natural gas engine line, the 130-hp Model G333, is particularly suited for use in air conditioning ignition, gas gathering, pumping, low temperature refrigeration and electric power generation. The G333 takes full advantage of diesel strength standards, which allow up to 25,000 hr of operation before first overhaul.
Caterpillar Tractor Co.

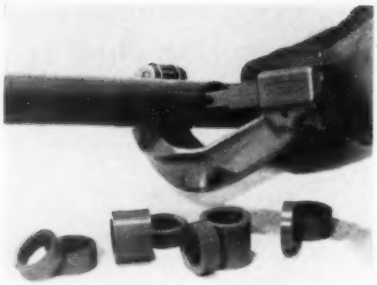
12. Temperature compensation

Temperature compensation is available in American Meter's new AL-800 Aluminumcase meter. The new tangent, utilizing the same design principle incorporated in American AL-250 domestic Aluminumcase meters, provides accurate gas measurement corrected to base temperature conditions.
American Meter Co.



13. Disposal unit

The new gas-fired Destroilet is said to be a giant step forward toward solving pollution problems. The individual disposal unit eliminates the need for water- septic systems, sewage pipe, etc. Two models of the LPG-fired unit are available —one for residential use and one for trailer and marine use.
LaMere Industries Inc.



14. Plastics pipe cutter

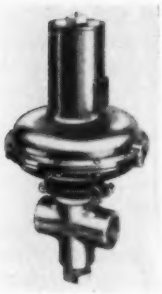
A specially designed cutting wheel is now available for use in the Ridgid No. 205 tubing cutter. The cutting wheel converts the tool into a plastics pipe cutter in a matter of seconds. Recommended for either thin or heavy wall rigid plastics pipe, the cutter has a capacity of up to 2 in.
Ridge Tool Co.

15. Leak detector

"Snoop" is a new liquid leak detector that finds leaks in pressurized gas or air lines. A thin, solid stream is applied to test each connection. It is reported that Snoop will even detect leaks at the bottom of connections in vertical runs where gravity tends to remove testing fluid.
Nuclear Products Co.

16. Utility vehicle

Two new soft tops, the Sport-Top coupe and Sport-Top full, are available for International's all-purpose utility vehicle, the Scout. Made of white vinyl-faced cotton drill, the tops enclose the cab, or the full-length space from windshield to tailgate.
International Harvester



17. Dump valve

BS&B's Type 70-23 valve is designed primarily for on-off applications in high pressure service. It can be converted to either globe or angle by merely relocating the body nipple. No additional parts are needed to reverse the actuator.
Black, Sivalls & Bryson

18. Infra-red heater

Siegler's gas infra-red residential heater gives instant heat without chilling air movement. The Solaroid bathroom heater can be pinned to the wall or recessed, vented or unvented. All models have positive, on-off dials and 100 per cent safety controls.
Siegler Heater Co.

TRADE LITERATURE

19. Compressors

Clark's TLA gas engine-driven compressors of 1700- to 3400-bhp size are covered in 56-page Bulletin 225. The compressors are for use in pipeline, gas storage, and process applications.
Clark Bros. Co.

20. Gas regulator

Fisher has designed an installation for the Type 403 high pressure gas regulator which greatly reduces chance of pilot freeze-up on high pressure applications. Bulletin P-101A presents complete information.
Fisher Governor Co.

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21. Pneumatic receiver

Product Data A113, 3.3-2 describes Bristol's Series 670 Metagraphic pneumatic receiver. The Series 670 is an important addition to Bristol's line of "functionally unitized instruments."
Bristol Co.

22. Gas Meters

Complete information on Arkla meters is contained in a new booklet. The two-color, 12-page brochure outlines the advantages and modern design of the V-175 and V-250 gas meters.
Arkla Meters

23. Seismic exploration

Information on the Model R-117 seismic timer for subsurface exploration is contained in a bulletin from Soiltest Inc. The portable timer locates hardpan, water tables and rock strata at depths up to 100 ft using seismic shock waves generated by a special hammer impact or by small explosive charges.
Soiltest Inc.

24. Gate valve

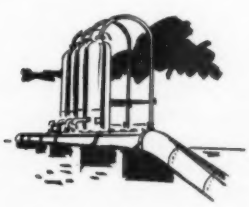
DeZurik's new rubber-seated bonnetless knife gate valve is described in Bulletin 302. Listed are features of the valve as well as materials, dimensions, actuators, and applications.
DeZurik Corp.

25. Gas regulation

Two new publications discuss Reynolds gas regulating equipment. Included are descriptions of the complete line of vents made as companions to regulators, and a safety test plate.
Reynolds Gas Regulator Co.

26. Industrial instruments

Barton's G1-14 industrial instrument bulletin includes product descriptions and specifications on the complete line of meter bodies, indicators, recorders, switches, transmitters, controllers and integrators.
Barton Instrument Corp.



Problem

Remove oil and casing head drip ENTRAINMENT from 4" feed line.

Solution

Hi-eF GAS SCRUBBER To eliminate burner problems in stress relieving and normalizing furnaces. A Type L 4-150 Hi-eF Line Scrubber was installed in 4" feed line from storage well replacing baffle-type scrubber.

Results

Handling 1.5 MMSCFD of natural gas at 60 PSIG this unique two stage scrubber, with no moving parts, removed approximately 30 gals. of liquid entrainment per month.

More Information

Write for Bulletin 601 or ask for an Anderson engineer to call.

Hi-eF PURIFIER

By the Manufacturers of Super-Silvertop Steam Traps

THE V. D. ANDERSON COMPANY

Division of International Basic Economy Corporation

1981 W. 96th Street Cleveland 2, Ohio

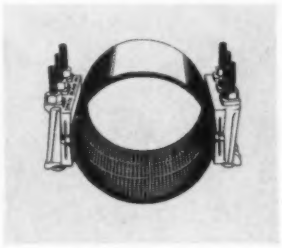
When a pipe breaks or springs a leak,

FIX IT AND FORGET IT

—for the life of the pipe!

No need to remind you that in most instances the major cost of repairing most pipe leaks involves locating, exposing and refill. You know this. Smith-Blair knows it, too! That is why every Smith-Blair product is engineered and manufactured to assure a *permanent* repair. A Smith-Blair repair unit properly selected and installed, will last for the remaining life of the pipe!

For example, Smith-Blair Full Circle Clamp Couplings.



These are designed to reconnect full breaks, repair holes, cracks and other damage in all types and sizes of pipe.

Permanence of repair with a wide margin of safety is assured by Smith-Blair design features that permit uniform pressure seal over 360°. These features are 1) tapered and finely gridded gasket; 2) recessed armor.

These Smith-Blair features, together with other data that will help you, are described in new Bulletin 1263. We will be glad to mail you a copy, without cost.

VALUABLE DATA YOU SHOULD HAVE

Smith-Blair manufactures a complete line for every pipe O.D. requirement. Check items that interest you, mail coupon today.

- ☐ Full Circle clamp couplings
- ☐ Taper-Seal service saddles
- ☐ Cast couplings
- ☐ Flanged coupling adapters
- ☐ Pipe repair clamps
- ☐ Compression couplings
- ☐ Steel couplings
- ☐ Tapping saddles; sleeves
- ☐ Fast-Action clamp couplings
- ☐ Expansion joints
- ☐ Meter couplings
- ☐ Pipe end caps

All of these from one, dependable source.

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—suppliers in all principal cities.

New pipeline has unique control system

BY the first of the year, if not as you read this, the Alberta-to-California pipeline, bringing Canadian natural gas to Pacific Gas & Electric Co., will be in operation. A Dresser Electronics/SIE Division pipeline supervisory and automatic control system will be placed in service on the portions of the pipeline system operated by Pacific Gas Transmission Co. (Spokane, Wash.) and Alberta Natural Gas Co. (Calgary).

The equipment will provide control for a 721-mile section of the 1400-mile natural gas pipeline. The contract includes nearly a half-million dollars worth of local station control and automatic start-up units plus supervisory and remote control equipment for sections of the pipeline in Oregon, Washington, Idaho, and British Columbia. The central dispatching control center for the system will be in Spokane, Wash. Provisions are included for control and remote supervision of additional compressor stations to be added in the future. Considerations have been given in the system design to possible future computer operation. High-speed data transmission, high data density, computer code language and other techniques made possible by solid-state circuits are used for compatibility with modern general-purpose digital computers.

The basic control concept is one of local automatic control at each station coordinated by remote supervisory control. Communication will be by party-line operations over microwave facilities. Dresser/SIE has completely supervisory system responsibility and is working with the Bechtel engineers (manager for the owning companies) and pipeline experts to provide one of the world's most modern control complexes.

The supervisory equipment continuously scans all remote points. Less than two minutes are required for up-dating all data, alarms, status indicators and other informa-

tion from all stations. Information is presented by means of electric typewriters, digital visual displays and status/alarm lights arranged for maximum operator convenience.

The automatic compressor stations will be under remote control by centrally dispatched pressure set points. The discharge pressure will be maintained by engine speed control and the number of units on line. The desired set point will be telemetered to the unattended stations.

Pocket clearances on reciprocating compressor units are under secondary control to keep the reciprocating compressor units at or near rated torque over the expected ranges of flow and pressure. This pocket clearance change is provided only at periodic intervals so there will be no interaction with the primary speed control loop.

The proper clearance for rated torque will be derived from a plotter-controller built around a conventional X-Y plotter. In place of the normal writing stylus in the plotter, a contact stylus will be lowered onto etched boards. Etched on the boards are the families of torque curves for the compressors.

Where centrifugal compressors are installed, a different type of control will be used. Engine speed and inlet guide vane position will be varied to provide optimum operation. In addition, compressor surge control will be provided.

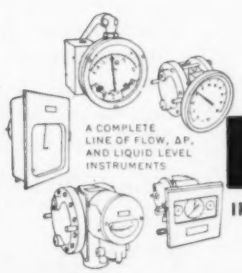
For all stations engine start-up panels will provide automatic start, stop, and unit loading according to a scheduled sequence of operations.

The telemetry portion of the system employs a design to insure fail-safe operation even if there is communication, component or power failure. Data conversion—analog-to-digital or vice versa—is accurate to one part in a thousand and message transmission accuracy is absolute.

Possible maintenance and service difficulties are eased by use of plug-in logic boards. All system functions are accomplished by a series of standard function boards, each constructed on etched phenolic boards. Standard maintenance includes use of a built-in marginal test circuit. Here two primary operating voltages are varied so that any marginal operation immediately becomes apparent.

PROCESS SYSTEM RELIABILITY BEGINS WITH BARTON INSTRUMENTS

Sooner or later, excessive maintenance, costly inaccuracy and questionable dependability are the problems you face with many differential pressure instruments—but not with Barton. Built on the original, patented, rupture-proof dual-bellows principle, all Barton instruments—indicators, recorders, switches, transmitters, controllers, integrators—deliver unerring accuracy, minimum maintenance, immunity to effects of overranging and, above all, unmatched dependability. Whatever the application, whatever the instrument need, don't buy problems—buy Barton.



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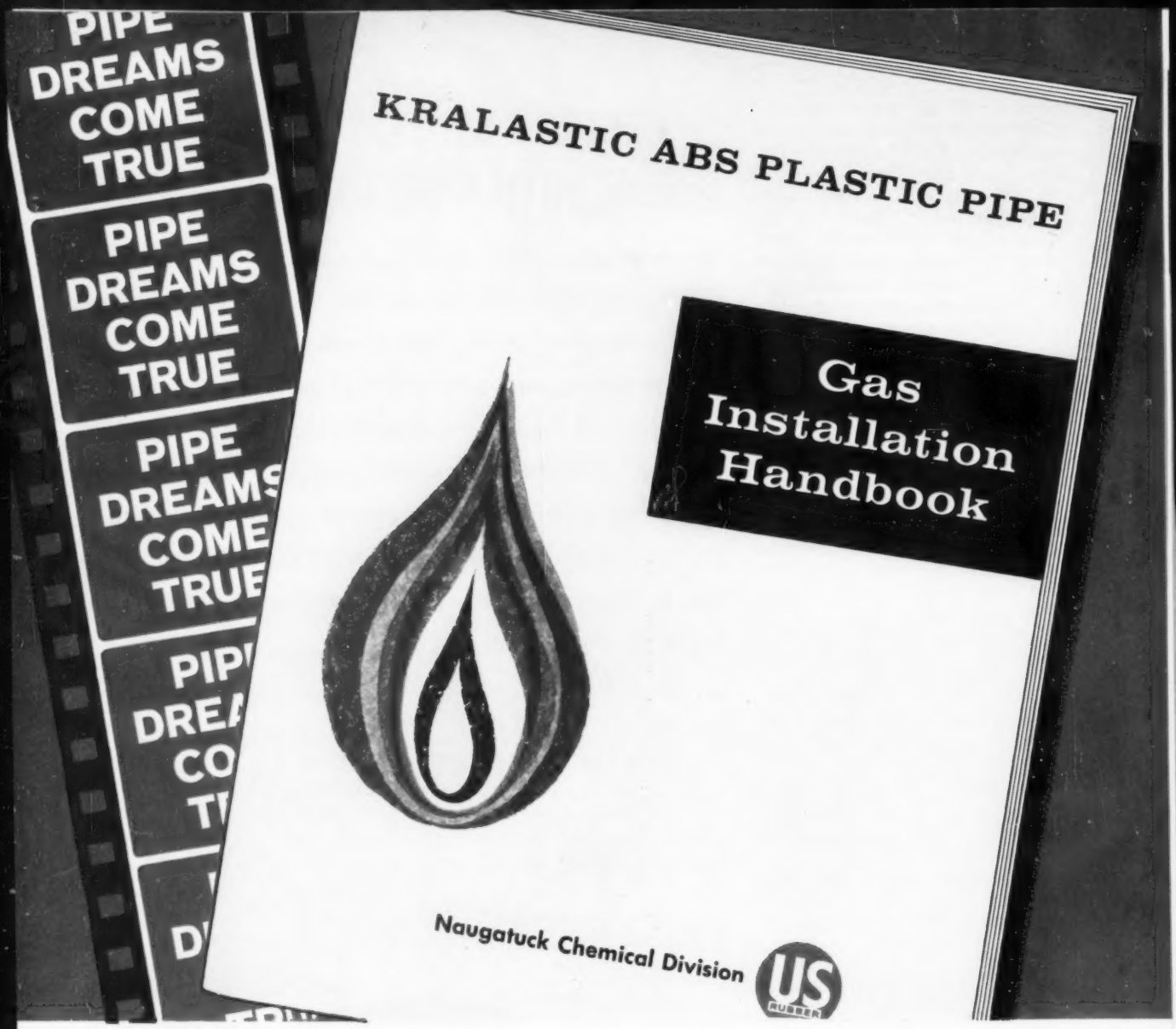


KRALASTIC Pipe Film... and Gas Handbook!

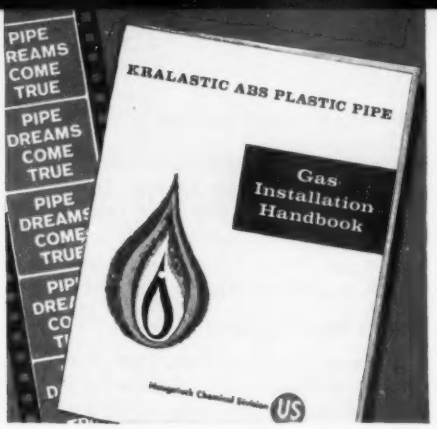
See why Kralastic® ABS pipe has been used in more than 16,000 miles of successful installations during the past 12 years.

PIPE DREAMS COME TRUE: A 16 mm sound color film featuring the definite proven advantages of Kralastic ABS pipe for oil-field gathering lines, potable water transmission, natural gas lines, domestic service, electrical conduit. Shows actual step-by-step installation shots. Illustrates, for first time, a new Emergency Gas Control System developed by Arizona Public Service Company.

GAS INSTALLATION HANDBOOK... Describes installation and joining techniques; "hot" and "cold" tapping methods; compares pipe prices; gives size and working pressure recommendations, flow tables, physical properties, emergency control procedures; presents recommended specifications for engineering and purchasing departments. Invaluable information for all pipe users.

Contact nearest Kralastic ABS Pipe Manufacturer for Gas Handbook and free use of film.

NAUGATUCK CHEMICAL DIVISION US RUBBER **United States Rubber**



Write these leading pipe manufacturers for film presentation and Handbook

ARIZONA
Arizona Plastic Extrusion Company
1347 North 22nd Avenue, Phoenix
Southwestern Plastic Pipe Co. of Arizona
1837 West Roosevelt, Phoenix

CALIFORNIA
Amco Plastic Pipe Company
2002 Davis Street, San Leandro
Baldwin Extruded Products
12200 Woodruff Avenue, Downey
Lasco Industries, Inc.
1561 Chapin Road, Montebello
Sloane Manufacturing Company
7606 North Clybourn Avenue, Sun Valley

CONNECTICUT
Anaconda American Brass Company
414 Meadow Street, Waterbury 20

FLORIDA
Plastiline, Incorporated
1251 N. E. 48th Street, Pompano

ILLINOIS
Anesite Company
3575 Touhy Avenue, Chicago 45

INDIANA
Chase Brass & Copper Company, Inc.
1609 Oliver Avenue, Indianapolis 21
Crescent Plastics, Inc.
955 Diamond Avenue, Evansville 7

MASSACHUSETTS
Plymouth Cordage Company, Plymouth

NEBRASKA
Western Plastics Company
1515 West Second Street, Hastings

NEW JERSEY
American Hard Rubber Company
Ace Road, Butler
Triangle Conduit & Cable Co., Inc.
Triangle and Jersey Aves., New Brunswick

OHIO
The Evanite Plastic Company
Division of The Evans Pipe Company
RD 4, Carrollton
The Plastex Company
3232 Cleveland Avenue, Columbus 24
Republic Steel Corporation
Republic Building, Cleveland 1
Yardley Plastics Company
142 Parsons Avenue, Columbus 15

TEXAS
Southwestern Plastic Pipe Company
P.O. Box 117, Mineral Wells

WASHINGTON
Portco Corporation
Paper and Plastic Division, Vancouver
Western Plastics Corporation
3110 Ruston Way, Tacoma 2

United States Rubber
NAUGATUCK CHEMICAL DIVISION
Naugatuck, Connecticut

Companies vie for Georgia territory

Hearings reconvened early in November to decide which company is going to provide natural gas service to several southeast Georgia towns.

Atlanta Gas Light Co. wants to build a 170-mile line from Savannah to service Brunswick, Waycross and other towns.

Georgia Central Transmission Co. represented by the former governor of Texas, Allen Shivers, is fighting the application and seeking to serve much of the same territory.

South Atlantic Gas Co. also is protesting Atlanta Gas Light's attempt to serve Bryan county, which is adjacent to South Atlantic's Chatham county territory.

Both Atlanta Gas and Georgia Central would obtain their gas supplies from Southern Natural Gas Co.

Alaska names PSC members

Members have been named to the Alaska Public Service Commission, which was created by the state legislature in May 1959.

Charles F. Herbert serves as chairman. Commissioners are Karl L. Walter Jr. and Clyde S. Courtnage.

The commission concerns itself only with regulation of motor transportation and air commerce. All other utilities are unregulated except by local ordinance.

New members elected by GAMA

Several manufacturers, including one South American firm, have been elected to membership in the Gas Appliance Manufacturers Association. They are:

ICASA of Bogota, Colombia; United States Steel Corp., Pittsburgh; Apache Products Co., Phoenix; Tafco of Los Angeles; Nicolet Industries Inc., Florham Park, N. J.; Fannon Products division, Hupp Corp., Detroit; AiResearch Manufacturing Co., Phoenix; Kaiser Aluminum & Chemical Corp., Oakland, Calif.; Henry Furnace Co., Medina, Ohio; and Rehrig Safety Controls division of Rehrig Pacific Co., Los Angeles.

BU plans $105 million 5-year expansion

Brooklyn (N.Y.) Union Gas Co. will spend $100 to $105 million on new construction over the next five years. President J. E. Heyke said the expenditures are necessary to meet continued growth in demand in BU's service area.

Space heating is still regarded as the principal load factor with gas air conditioning becoming more important in the commercial and large industrial fields.

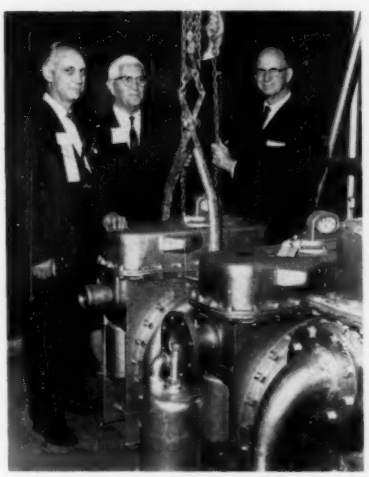
Space heating installations have been growing over the years but Heyke pointed out that the market is only a third saturated.

SoCounties mixes division personnel, civic leaders

Southern Counties Gas Co.'s Santa Monica Bay division recently hosted civic leaders and government officials at an open house designed to acquaint them with the operations of the gas company.

The event is part of SoCounties public relations program to strengthen ties between division personnel and key people in the communities they serve. Featured were exhibits of gas company equipment and operating techniques.

Shown here examining large industrial meters are (from left) J. Q. Abel, controller and treasurer of SoCounties; Burton Chace, Los Angeles county supervisor; and W. C. Bullock, SoCounties Santa Monica Bay division manager.



OFG's microwave system under construction

Construction and installation is under way at 10 locations in southern and central Ohio on the $685,000 microwave communications system for Ohio Fuel Gas Co.

OFG's network will become part of a four-state, 29-station communications system to serve Ohio Fuel and other Columbia Gas subsidiaries. The network is expected to be ready for operation late next fall, according to Paul W. Rogers, OFG's vice president and chief engineer.

The Ohio portion of the system is capable of providing 240 channels. Initially, it will provide Ohio Fuel with 1750 channel miles of circuits. Rogers said the system will transmit information to and from a centralized accounting computer center. It will be used for warehouse and stock control accounting, data processing, and other operations where high-speed communication facilities are advantageous.

In addition, the system will permit enlargement of the company's voice communication system, teletypewriter service, facsimile facilities, and telemetering service.

SGA's convention programs honored

An award for outstanding printed convention materials was presented to the Southern Gas Association by the American Society of Association Executives.

SGA's entry, which took second place in the "Idea Fair," consisted of printed materials developed for the annual convention held last spring in New Orleans. Included were the convention programs, bulletins, badges, directory, and invitations to entertainment and activities. A feature of the materials was the coordinated design and color.

Wayne Bovee heads Gild of Ancient Supplers

Wayne H. Bovee, division sales manager of Hardwick Stove Co., has been elected to serve a two-year term as Mayor of the Gild of Ancient Supplers. He succeeds Karl W. Schick, Minneapolis-Honeywell Regulator Co.

Other new officers include: senior warden, Lee A. Brand, Empire Stove Co.; keeper-of-the-treasure, Leslie B. Moxon, Joseph Scholl Inc.; clerk, William B. Ashby, American Meter Co.

Aldermen are: West Coast, Jack F. Ray, General Controls Co., Glendale, Calif.; Southwest, Thomas F. P. Kelly, Mavor-Kelly Co., Houston; Southeast, Francis K. Toney, M. M. Hedges Manufacturing Co., Birmingham; Midwest, M. Ben Gault, Robertshaw-Fulton Controls Co., Youngwood, Pa.; Northeast, Sol W. Weill Caloric Corp., Wyncote, Pa.

Turbine power package covered in filmstrip

A color-sound filmstrip based on the SGA-AGA report, "A new look at new schools" will soon be available.

The film will highlight the many features of the completely air conditioned secondary school—flexibility, controlled environment, convenience, freedom of teaching, high frequency lighting—while stressing that the gas turbine power package helps make possible all these advantages at less first cost and lower operating costs.

install Lancaster meter parts for proven quality and performance

Lancaster
VALVE COVERS
Engineered to prevent most common valve problems. Oversize stud provides friction-free contact with index drive flag. Micro-finish lapped surface assures perfect seal. Extra heavy valve shell covers top and sides of carbon-graphite ring for full protection.
Lancaster non-crack
SYNTHETIC DIAPHRAGM
Quality proved in meters from coast to coast. Rolls smooth without wrinkles. Reinforced at all flexing and hinging points. High flexibility and low differential. Installed without changing gear ratio or replacing standard parts. For best performance use our adjustable height oval slot carrier wires for straight line diaphragm movement.

a meter is only as accurate as its parts

Lancaster METER PARTS CO.

Manufacturers of Quality Parts for Gas Meters

POST OFFICE BOX 412 LANCASTER, OHIO

PUC freezes Peoples Natural's rates

Pennsylvania's PUC froze existing gas rates of Peoples Natural Gas Co., Pittsburgh. The freeze was ordered pending a final order on the company's plan to raise rates of 261,300 customers an estimated $3.2 million annually.

A nine-month suspension ended on Nov. 1. The commission prescribed temporary rates until it can reach a decision. Protesting the increase are the City of Pittsburgh, the boroughs of Aliquippa and Tyrone, and the Puritan Sportswear Corp., Altoona.

Also under suspension until Dec. 11 is Peoples Natural's proposal to read meters every two months instead of monthly. The company said this move would cut rates about $225,000 a year, or 7 cents a month per individual bill.

PNGMA dedicates memorial at Haymaker Well

A memorial stone on the site of the largest gas well in western Pennsylvania was dedicated recently by government officials and gas industry representatives. The stone marks the location of the famous Haymaker Well in Murrysville, about 20 miles east of Pittsburgh.

Participants in the ceremony (see photo) included Christy Payne, Jr. (left), of the Consolidated Natural Gas System. Payne is chairman of the Pennsylvania Natural Gas Men's Association memorial committee. At right is John T. Galey, president of PNGMA, master of ceremonies at the dedication.

If this Housing ever Breaks or Distorts we will replace it Free
RIDGID
HEAVY DUTY
Skilled Hands Know the Difference...
Genuine
RIDGID
At Your Supply House!
The Ridge Tool Company, Elyria, Ohio, U.S.A.

Florida leans toward municipal gas systems

If present trend continues, Florida will be among the nation's top-ranking government-in-gas states by the end of the year.

A recent FPC decision approving pipeline expansion in the state paved the way for municipal gas interests to take another giant step forward.

Of the 14 communities soon to get natural gas service, 11 have indicated they will operate municipal systems, raising the total number of such operations in Florida to 33. This figure is exceeded by only seven other states.

Two years ago, Florida had only 12 municipal systems. Today, Florida has more government-owned gas systems, 22, than it has investor-owned companies, 16.

Municipal gas revenues are 17 per cent of the Florida industry total, while the national average is only 5 per cent.

Washington Natural forms new division

J. Wilson Gaw, public relations vice president of Washington Natural Gas Co., Seattle, has been named vice president in charge of the newly established eastern division.

The new division, formed because of rapid expansion of the area, is located in Bellevue. It will provide complete customer service for 12 incorporated communities in addition to many unincorporated communities. Population exceeds 25,000 people.

William P. Woods, president of Washington Natural, said that "Since 1956, when we had no customers within this area, we have grown to more than 5000 users of natural gas. Conservative estimates indicate that within the next five years we will more than treble this growth."

Industry injuries down

Disabling injuries in the gas industry dropped to a record low in the second quarter of 1961.

An AGA sampling of 83 representative companies showed a 14.4 per cent decrease. The frequency rate in the second quarter was 5.35 disabling injuries per million manhours, compared with 6.25 a year earlier.

Southern Union gets 9.3% rate increase

Southern Union Gas Co. was granted a 9.3 per cent increase in rates for general service customers by the New Mexico PSC. At the same time, the company was told to refund 58 per cent of a boost it has been collecting since September 1959.

The $1.3 million a year increase allowed is about 42 per cent of the amount sought. Southern Union asked for a 22.1 per cent boost in general service rates, intended to produce $3 million in additional annual revenue.

NI-Gas sponsors community development conferences

First in a planned series of community development conferences sponsored by Northern Illinois Gas Co. was held recently at East Hazelcrest, Ill.

About 160 civic, business and commercial leaders and municipal officers attended the day-long session.

J. H. Roth and Jack Sticklen of NI-Gas' area-industrial development department conducted the conference. Similar seminars will be held for other communities in northern Illinois, Roth said.

Here's an **extra** gas passage in a gas appliance pressure regulator. Included in Maxitrol's RV-31, it leads from the outlet side to a tap on **top.**

This outlet pressure tap enables quick, accurate outlet pressure readings with a manometer. Users don't have to buy special left hand or right hand outlet taps, don't have to stand on their hands to take a reading from installed regulators.

RV-31 is available in three sizes, ⅜ x ⅜, ½ x ⅜, and ½ x ½ with maximum capacity of 100,000 btu/hr.

MAXITROL COMPANY, 23555 TELEGRAPH ROAD, SOUTHFIELD, MICHIGAN

Temperature Compensation Throughout The Line

AMERICAN® ALUMINUMCASE METERS

Temperature Compensation, pioneered and developed by American Meter Company, is now available in all models of Aluminumcase Meters—domestic, commercial and industrial. Kits are also available for converting most American domestic Ironcase and Aluminumcase Meters to Temperature Compensation. Contact your American representative for complete details on how Temperature Compensated Meters can benefit you.

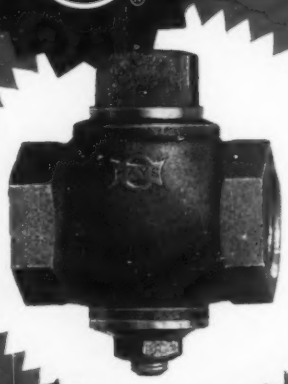
AL-800 ALUMINUMCASE METER for medium sized industrial or commercial loads. Weighs only 46 pounds. Rated capacity 800 cfh at ½-inch w.c. and 1700 cfh at 2-inches w.c. differential with 0.64 sp. gr. gas. 20 psi maximum working pressure. Connections 1½-inch MC. Permanent steel connection threads eliminate galling.

American Temperature Compensating Meters are the result of years of research and development to bring you the most modern, accurate measurement equipment—another advance in gas measurement technology, pioneered by American since 1836, for the benefit of the entire Gas Industry.

AMERICAN® METER COMPANY

Sales Offices in Principal Cities

HAYS



all Brass GAS STOPS

for...

SERVICE LINES
Low, Medium and High Pressure

METER SETTINGS
Flat Head • With or Less Check
Lock Wing

INDUSTRIAL USE
Three-Way • Graduated Dial

APPLIANCES and EQUIPMENT
Lever Handle • Square Head
Flat Head
A.G.A. Listed Control Valves

GENERAL PRODUCTS DIVISION
HAYS MFG. CO.
ERIE, PA.

Colorado PSCo. plans high gas line extension

Public Service Co. of Colorado has announced a $3.5 million expansion of its recently completed $6 million pipeline—the nation's highest pipeline.

The company is seeking PUC approval of the 150-mile extension which will bring natural gas to the Western Slope cities of Saguache, Buena Vista and 2-mile-high Leadville. The new line, with its service extension, would connect at Del Norte with the recently completed line into the San Luis valley. This line runs from a point in the Ignacio gas field on the Southern Ute Indian Reservation in deep southwestern Colorado through the San Juan River valley and over the Continental Divide at an altitude of 12,000 ft.

No other transmission line in the states reaches such a lofty altitude and Public Service Co. officials describe its construction as a major engineering feat.

Many miles of trench had to be blasted through solid rock at high altitudes. At one point near the summit, the trench goes through solid rock for 15 miles.

Special heavy equipment was used to transport men and materials over the steep right-of-way. At many points it required two bulldozers to pull a single truckload of pipe into position.

The coming of natural gas to the San Luis valley touched off a business boom in the heating and appliance industries. Many homes in the area still are heated by coal. Until now, most appliances in the valley operated on L.P. gas.

SGA and AGA combine spring meetings

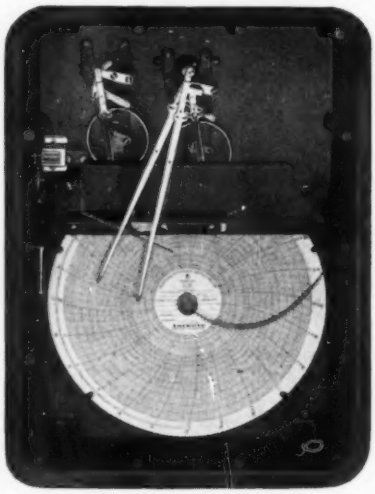
The AGA and SGA will get together in Houston on April 30-May 1 for a combined SGA annual convention and AGA transmission conference. An attendance of 2800 is expected.

Both groups will alter the format of their customary meeting in order to make it possible for all in attendance to take advantage of the combined meeting sessions.

NEWS NOTES

AGA Research Bulletin 89 presents complete details of an experimental domestic gas oven which

INTEGRATING ORIFICE METERS



American® Integrating Orifice Meters provide more accurate measurement by the continuous multiplication of the square root of the measured differential by the square root of the absolute line pressure.

Single, double and duplex-integrating models available in a wide range of manometer types and working pressures. Dustproof, die-cast aluminum cases... Gasclok and electric instrument chart drives. Also supplied with American Telecounter for remote readings.

See Bulletin 401 for details.

AMERICAN METER COMPANY

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speeds up baking of layer cakes with less fuel consumption. Also discussed are design criteria for minimizing appliance heat loss to the surrounding atmosphere. Additional information is available from the AGA Labs, 1032 E. 62nd St., Cleveland 3, Ohio.

Marbon Chemical Division of Borg-Warner Corp. has purchased a plant site at Grangemouth, near Edinburgh, Scotland, for construction of a plant to produce Cycolac brand polymers and other synthetic resins.

Rayflex Exploration Co. is building a new combined office and laboratory building in Dallas. The new structure, planned for occupancy in February, will comprise some 16,500 sq ft about equally divided between administrative and research offices and manufacturing areas.

Motorola is offering a pay-as-you-learn plan to technicians wishing to take the Motorola Training Institute home-study course covering principles and servicing of two-way radio systems. Additional information is available from Motorola, 4501 W. Augusta Blvd., Chicago 51.

Marbon Chemical division of Borg-Warner Corp. has reduced price of Cycolac brand ABS plastic, ranging from 10 to 14 per cent per pound in truckload quantities.

Philadelphia (Pa.) Electric Co. is getting the 25th Honeywell 800 large-scale electronic computer. The company will use the 800 to automate the billing of its 1.1 million customers, to help solve engineer problems, and for general accounting purposes.

James H. Stannard, Jr., formerly with Pacific Gas & Electric Co., has organized a new firm offering an integrated engineering service. Stannard & Co. headquarters in San Francisco.

The six millionth glass-lined water heater has rolled off the production line at A. O. Smith Corp.'s Consumer Products division in Kankakee, Ill. According to M. E. Morgan, vice president, the achievement, covering a span of 20 years, represents the greatest volume production of any single manufacturer in the industry.

THE GEM OF THE GAS INDUSTRY!

Here's the NEW LOOK!

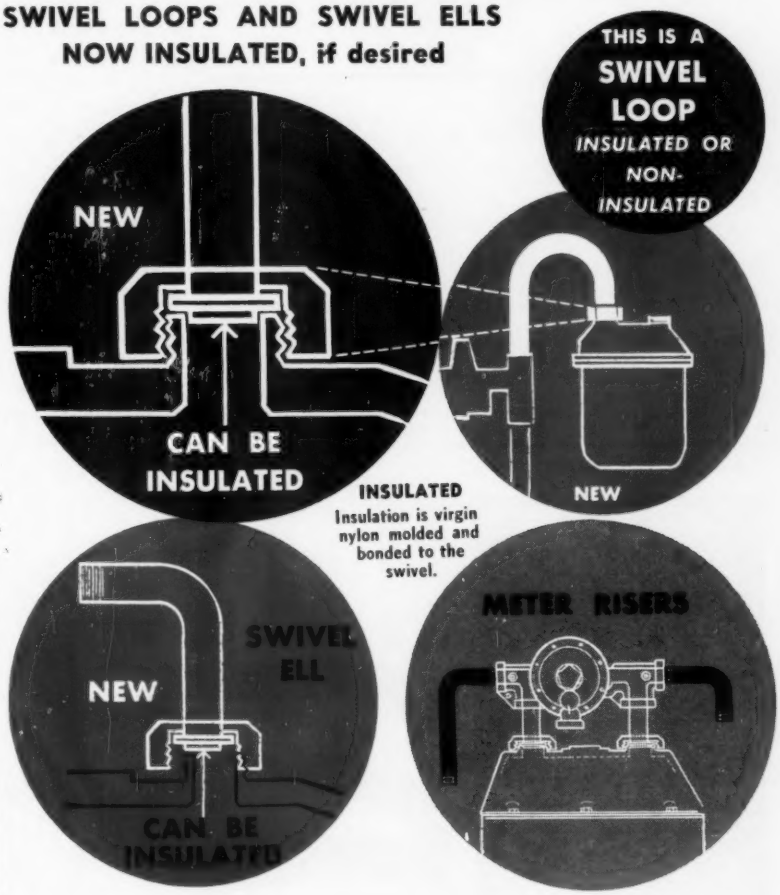
ONLY 2 CONNECTIONS!

NEWEST

PRODUCTION

SWIVEL LOOPS AND SWIVEL ELLS

NOW INSULATED, if desired



Install faster . . . at least cost . . . no thread or connections . . . no leaks. Built to your specifications.

Interchangeable with present hook-ups. Available in ¾", 1" and ¼" pipe.

Meter loops (180°) and meter risers (90°). Swivel ell or swivel loop with or without insulation. Also available with or without orifice fitting.

Write for details and prices and for representative to call.

PRODUCTION Plating Works Lebanon Ohio

Manifolds and Supply Pipes for the Gas Industry

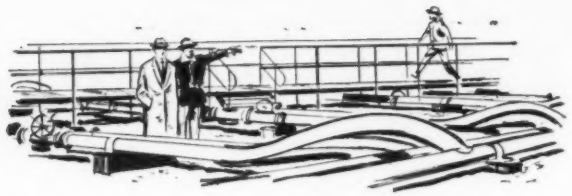
Continued from page 60

is the removal of 12,000 Btu per hour. Unfortunately, the ton has been used, and misused, to the point where many are not sure what a ton is in actual practice. Often the motor rating, in horsepower, is used as being equivalent to tons. Under realistic conditions, this is also deceiving. There is no reason why capacity of air conditioning should not be rated and evaluated in the same way that a heating system is evaluated. That is, taking into account the heat transfer coefficients of the building material, average outside temperature, desired inside temperature, and human and other radiating heat sources. A handy guide for preliminary estimates of cooling capacity requirements is in *Table 1.*

TABLE 1. Tabulation of 12,000 Btu/Hr Loads*

Average home	400 sq ft	Insulated home	500 sq ft
Office building (1-story)	350 sq ft	Multi-story	450 sq ft
Sales space	250 sq ft	Restaurants	250 sq ft
Auditorium	150 sq ft	Banks	300 sq ft

*These loads are for rough estimation only and will vary widely depending upon local climatic conditions, activity of the occupants, construction of building, vegetation, etc. Capacity requirements should be evaluated by qualified air conditioning engineers.



The atmospheric burner and air conditioning unit account for the bulk of the gas load (other than industrial) that uses natural gas as a chemical feedstock. U. S. industry uses gas in 25,000 different ways; however, they differ for the most part from the normal cooking load only in terms of temperature of application. For example, the U. S. Bureau of Mines has shown that a 5 per cent addition of natural gas to blast furnaces can boost iron output by 20 per cent and reduce coke consumption by 30 per cent. The same generally holds true for electric steel furnaces.

Now that produced gas, from well or gas machine, has been transported through mains to home and factory, it is necessary to look into some of the specialized problems of the gas industry. Some of the important properties of gas have been considered and applied to specific problems. In Part 7 we want to take a close look at methods of gas analysis. ■

NOW 2!

ARKLA GAS METERS

V-175—175 cu. ft./hr. capacity
V-250—250 cu. ft./hr. capacity

WE NOW MAKE TWO Arkla Gas Meter models . . . they look alike, and *are* alike, except for the capacity. Same fine workmanship, same lasting, corrosion-proof finish . . . and most important: *Extremely accurate!* **Order Arkla Gas Meters today.**

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RUSSELLVILLE, ARKANSAS
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Continued from page 12

convert itself into a pure gas industry. To the extent that this occurs, additions to gas reserves will be forthcoming from this source."

Dr. Netschert said that there is no evidence that the limits of hydrocarbon occurrence in nature are being reached. He asserted that:

". . . there are still large unexplored areas to be investigated, including, among others, the Continental Shelf and the entire Atlantic Coastal Plain. Second, there are further possibilities in known productive horizons, as shown by continued new discoveries. Third, there are possibilities in unorthodox sources, such as basement rocks and continental deposits. Fourth, and most important, are the opportunities in both productive and unexplored areas at greater depth. There is now wide agreement among the experts that the gaseous phase predominates at depth. The occurrence of gas and gas-condensate reservoirs at great depth in south Louisiana and the adjacent offshore areas is well known.

"It is becoming clearer that this is by no means an isolated phenomenon. Gas and gas-condensate reservoirs are predominant at depth in Pennsylvania and West Virginia, the Green River-Red Desert basin, the Anadarko basin, and Arkoma basin.

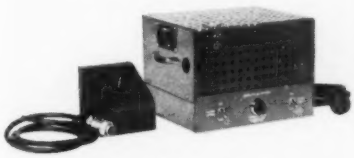
"In addition, although this is not related to the environmental occurrence of gas, I should mention as another important element of future gas supply that has recently been highlighted by an authoritative source, the contributions to future reserves which will come from currently known fields and pools. The National Petroleum Council, in its recent study of proved discoveries and productive capacity, called attention to the importance of the 'extensions and revisions' portion of new reserves over the long period, and the fact that a reservoir contributes to the extensions and revisions portion of new reserves over a long period, not just for a few years. The greater the number of known reservoirs, the larger the base from which extensions and revisions will accrue, and the quantitatively greater will be the total

Protective Coating Inspection Problems?

Here's Your Answer

No matter whether you're coating a pipeline or a chemical tank, continuity is vital. Use of a Tinker and Rasor Holiday Detector while the job is open, can save days of downtime later on.

• PLANT AND YARDS

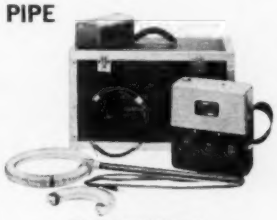


Tinker and Rasor
EPAC Holiday Detector or J-1ACM

EPAC operates off 110 volts A.C. power for stationary coating operations. Internal voltage adjustment from 5,000 to 20,000 volts or with external variable transformer from 500 to 6,000 volts, or 5 KV to 20 KV.

J-1ACM for continuous inspection on coating and wrapping machines which use water for cooling.

• PIPE



Tinker and Rasor
E-P or E-4 Holiday Detectors

Output adjustable from 5,000 to 20,000 pulsating voltage.

E-P—All purpose for larger diameter pipe, damp or dry climate, pre-fab film or hot applied coatings.

E-4—Lower cost, dry surface type of detector specifically designed for smaller diameter pipe and flat surfaces.

• THIN FILM

Tinker and Rasor
M-1 Holiday Detector

For painted or sprayed thin film coatings such as vinyls and epoxies. Maximum applied voltage 67½ V., non-destructive to coatings. Belt mounted, 4-lbs. total weight.

• UNDERGROUND

Tinker and Rasor
Pearson-type Holiday Detector

For detecting holidays and electrical shorts without uncovering the pipeline. Completely transistorized . . . generates 15 watt, 750 cycle, stable A.C. Audio-frequency signal. Adaptable to null search method.

Tinker and Rasor has prepared a complete data kit which describes the null search system as well as other recommended procedures for inspecting protective coatings. Material includes technical data on equipment, general discussion of types of detectors, theory of operations, etc.

Engineering Note:
To insure a perfect application, include Tinker and Rasor Holiday Inspection. Write for specification guide.

Quality Control for Coating Application

TINKER & RASOR

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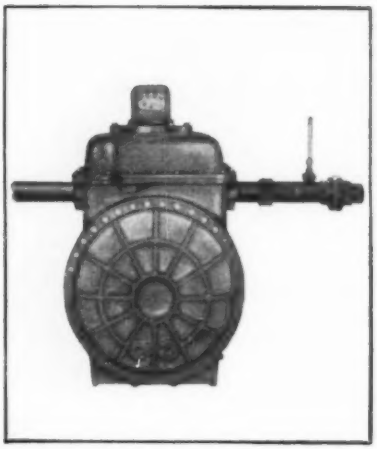

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annual contribution to extensions and revisions. Thus, there is basis for optimism regarding future supply on the score of reserve additions both from known sources and from what I would call 'true discovery'—the results of wildcatting."

Technological advances in production, as well as discovery of gas, are important. Through the fracturing technique it is possible to produce hydrocarbons from a formation previously too tight for production. Through the multiple completion technique, it is possible to produce from a horizon too thin to warrant drilling by itself. The significance of both instances is that they increase the available supply.

In stating his conclusion on the future cost of gas, Dr. Netschert declared:

" . . . the wellhead cost of gas in the U. S. through the coming decades, at the least the next 20 years, will not rise because of the physical scarcity of gas. By this I mean that there is sufficient gas in the ground to meet projected needs over this period and that existing and foreseeable technological capability will be adequate to discover and produce this gas. In other words, I do not believe that the gas existing in nature and remaining to be discovered is of so small a quantity as to be the basis for any limitation on the availability of gas during the next two decades and probably longer. * * *

"It is likely that the continued probing of the environment for additional gas supplies will involve both a more intensive and more extensive effort than has been true in the past. I believe, however, that the cost of this greater effort will be offset by countervailing effects."

The necessary deeper drilling is the most important factor tending toward increased gas costs in the future, but Dr. Netschert thinks that those costs will be offset by technology. ■

Washington • Continued from page 17

preted this provision rather broadly. It is our view that the notice and hearing procedure should be accorded. . . ."

The only exception to this new general policy will be when there is an emergency and a "comparatively minor" enlargement or extension is proposed.

Granting of temporary pipeline construction authority came under heavy fire about a year ago, during the election campaigns, primarily from consuming-area Democrats. They accused the Republicans of using a "loophole" in the law to favor pipelines without regard to the consumers' interests. The furor died down after the election, but the charge was apparently not forgotten by the Kennedy Administration.

Other changes are in prospect on other fronts as well. Taxes face a major overhaul, although neither a general increase nor a general cut is in prospect.

The Kennedy Administration is running short of funds to pay for generous social programs coupled with a toughened-up defense program. Some of the extra revenue will come from the higher taxes a budding economic recovery will produce. But not all. A modest deficit for the next year is acceptable to the White House. But a big one is in prospect.

So the Administration has this general plan in mind:

Close tax loopholes, including a cut of 5 or more percentage points in the gas and oil depletion rate and a tightening up in business expense accounts next year; increase tax income in future years by encouraging business expansion through selected tax incentives.

If, as expected, the White House asks for a cut in the depletion rate —or even demands a congressional study of the rate, which is much the same thing—it will be the first time in recent years that the power of the President has been put behind such a drive. This could bring success to the perennially unsuccessful proposal.

At the same time, a proposal to cut the allowance for so-called intangible drilling costs is likely to be sought by the Administration. This is almost a sure bet if it is requested.

'Kennedy agency'

THE Federal Power Commission will be truly a "Kennedy agency" after next January.

After President Kennedy names a replacement for former chairman Jerome K. Kuykendall, who has resigned effective Jan. 1, he will have named all five of the present commissioners.

Mr. Kuykendall, whose term was not due to expire until next June 22, had been expected to resign after he backed away from a showdown with the President over whether he could, if he wanted, continue as chairman after the Republicans lost control of the White House.

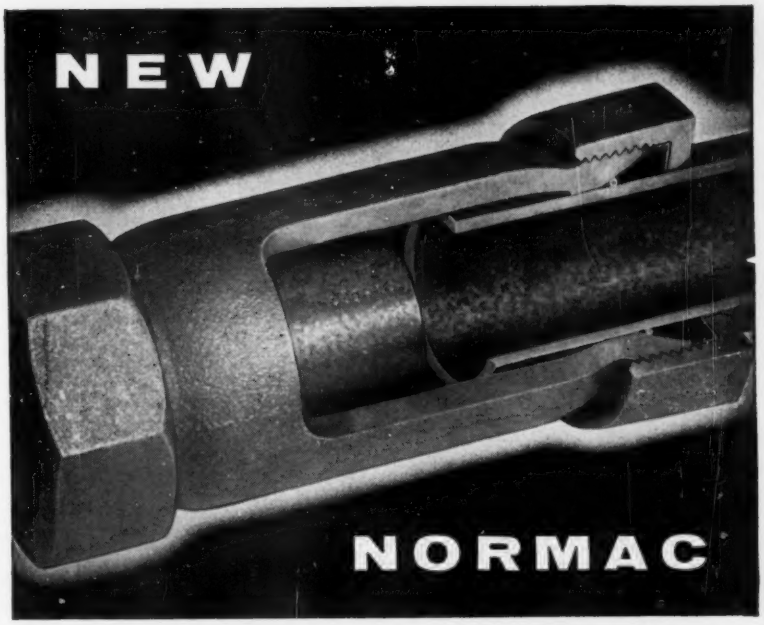
With only one exception, the four Kennedy appointees have been closely following the leadership of the new chairman, Joseph C. Swidler. The exception is Commissioner O'Connor, who dissented recently in a case involving El Paso Natural Gas and federal regulation of gas to pipelines not intended for resale.

Although the White House is permitted to name only three members of its own party (Democrats), it may name independents to the other two posts. Thus, the fifth Kennedy appointee may be either a Republican or an independent. Chances are good that it will be an independent or a liberal Republican who gets the job.

With the hope of any congressional help in the gas regulation battle erased for the foreseeable future, the makeup of the commission is of prime importance.

And there is little doubt that gas industry legislation is a corpse.

There is some of the usual Fall "let's get action on a gas bill started early" talk. But chief sponsor of gas bills in recent years, Rep. Oren Harris (D., Ark.), chairman of the House Commerce Committee, is pretty well disgusted with the lack of industry support he has received in past efforts to push such legislation. This year, he introduced two bills, but never bothered to hold hearings. He has made it clear in recent months in talks to industry spokesmen that unless and until the industry can come up with unified approach to the problem, and work hard—and sensibly—for



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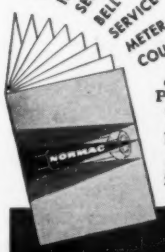

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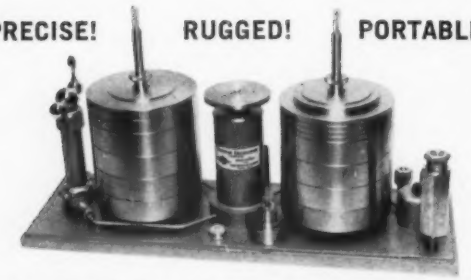

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20,000 pounds safe hoisting capacity

Outstanding features of the NEW KOENIG WINCH:

★ Drum torque load is NOT transmitted by drum shaft . . . no keys to shear . . . torque is transmitted direct from gear spider to drum by means of multiple-splined collar in gear housing.
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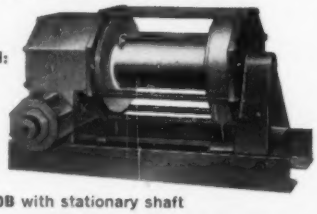
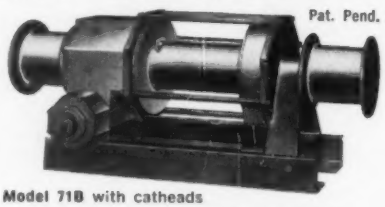


Model 70B with stationary shaft

Pat. Pend.



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it, he's not going to stick his political neck out again.

There'll be no support from the Federal Power Commission for such legislation either. Chairman Swidler and Commissioner Morgan have made it clear they do not favor the theory of past gas bills, at least for the present. The most the FPC might be expected to do would be to support a measure to legalize the area price approach, should it run into legal snags.

In addition, there is an air of decreasing support evident at the FPC of the proposal earlier in the year to exempt only small producers (under 2 Mcf a year in interstate commerce).

Commissioner Morgan was probably the first to voice this disenchantment with what had been billed as a sort of panacea for the backlog problem. He pointed out before the West Central Texas Oil and Gas Association in mid-October that there is doubt that exempting only one category of producer is legal and freeing small producers from price control could easily touch off escalation clauses in major producer contracts.

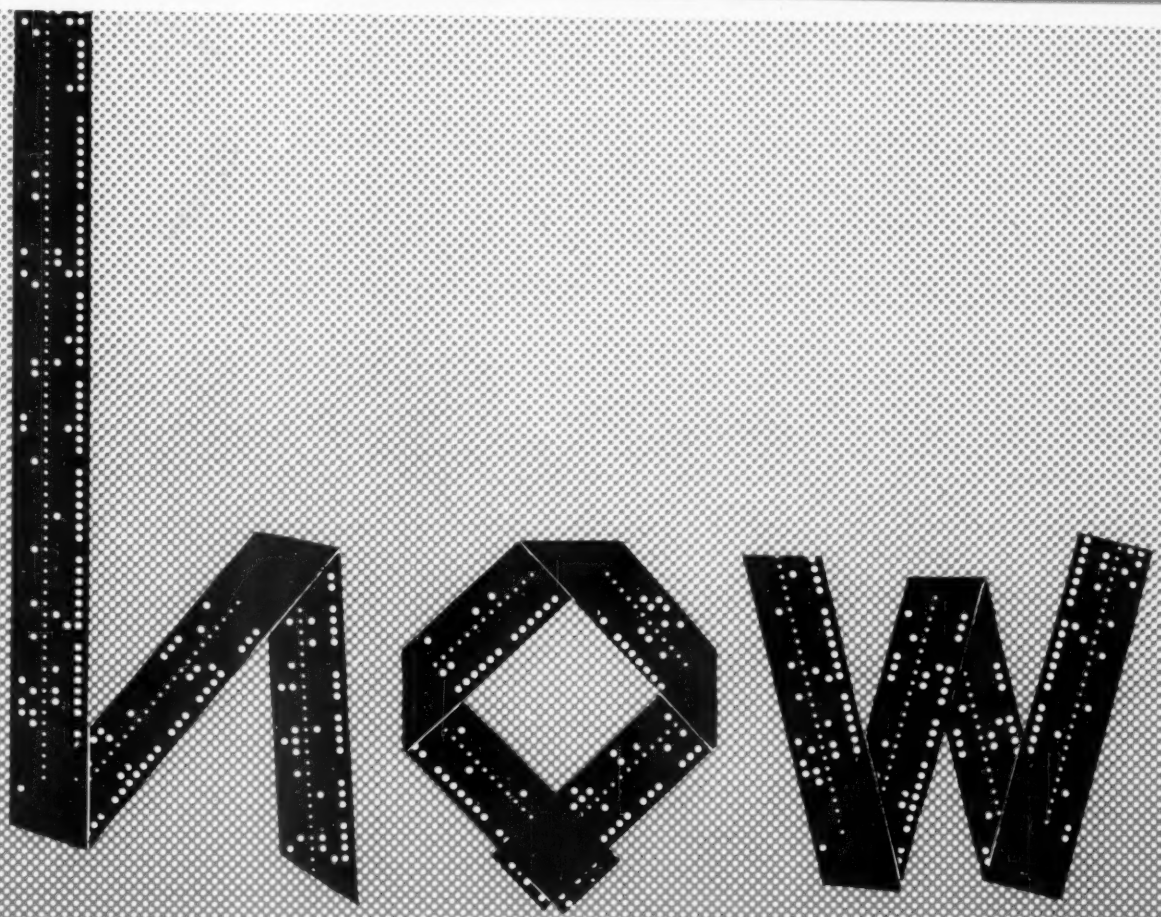
Meanwhile, the U. S. Supreme Court will have a chance this Winter to increase the FPC's grip on the gas industry. It has agreed to rule on whether the commission has the power to approve gas pipeline mergers, and whether this frees them from possible antitrust proceedings later.

The case involves the long-pending merger of El Paso Natural Gas and Pacific Northwest Pipeline Corp. The Justice Department's anti-trust division has been fighting the merger as a violation of the anti-trust laws in federal district court in Salt Lake City. But the FPC approved the merger, and was upheld by the District of Columbia Circuit Court of Appeals. It is this latter decision that is up for review by the high court.

The Justice Department is supporting the commission's power to rule on pipeline mergers, although still opposing the actual combination. However, both the FPC and the Justice Department contend that this approval does not free the firms from government antitrust prosecution later to block the merger. ■

GAS

PIPELINE SECTION



TEXAS GAS REDUCES HORSEPOWER TEST DATA .....

GAS

comes to Grandyle Village ...through Bethlehem line pipe

Into the ground it goes! Much of the Bethlehem pipe used on this project was plastic-coated with X-TRU-COAT by Pipeline Service Company, Sparrows Point, Md.

Iroquois Gas Corporation began laying distribution lines early in 1961 in Grandyle Village, a promising new suburb on Grand Island in New York State's Niagara Frontier. Connected to a 12-in. line laid under the river last Fall, these lines will bring gas to an initial 400 customers by the end of the year. The company estimates that, at the end of the 3-year, first-phase of the project, more than 80 per cent of the island's consumers will be hooked up to their lines. Some 170,000 ft of 2- to 6-in. line pipe will be involved, the great majority of it coming from Bethlehem's continuous buttweld and electric resistance-weld mills at Sparrows Point, Md.

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Thousands of tons of Bethlehem large-OD, electric fusion-weld line pipe are used in the transmission lines which will bring natural gas all the way from the Southwest. Smaller-OD Bethlehem steel pipe will carry it into the individual homes. Wherever it's used, Bethlehem line pipe provides tops in service . . . all the way.

Grand Island Is Booming

Just south of the Falls, the Niagara River divides to flow around an island larger than Manhattan. Virtually undeveloped until 1935 when two new bridges provided access to the mainland, Grand Island is one of the most promising growth areas on the Niagara frontier. Home and industrial construction is booming, stimulated by far-reaching plans to bring community services—such as natural gas service—to within reach of every corner of the island.

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HOW TEXAS GAS REDUCES HORSEPOWER TEST DATA

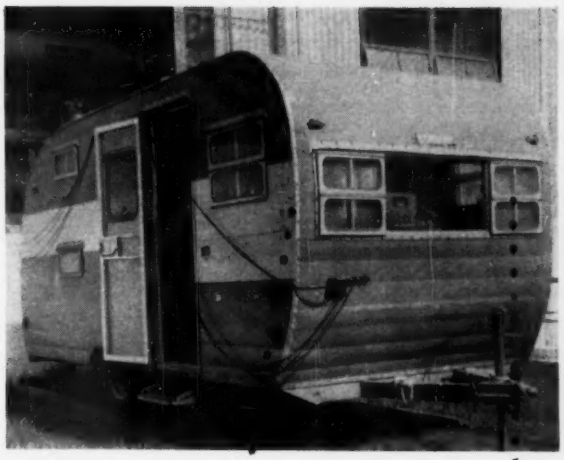


Fig. 1 (top right): Sixteen-foot trailer houses all necessary equipment to facilitate data collection. Interior of the trailer is shown in Fig. 2 (below right).

THE collection and analysis of engineering test data—horsepower and vibration tests, for example—can be a long and tedious job. Intelligent use of modern instruments can increase the availability and accuracy of test data collection and calculations. Since the engineer's time is most valuable when analyzing the test results, it is very desirable to process the test data as fast as possible. The availability of modern electronic instrumentation and the general use of digital computers has reduced the data processing time to a practical minimum. The Texas Gas data collection and processing system consists of the following:

1. Analog recording: A Consolidated Electrodynamic Corp. recording oscillograph system for the permanent recording of transient phenomena (DC to 5000 cps).

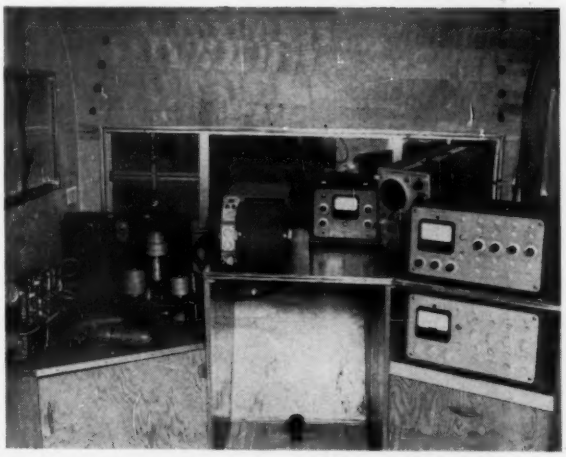
2. Analog-to-digital conversion: A Benson-Lehner oscillogram reader (Oscar Model J) system produces a punched tape and a typed sheet of the test data.

3. Data reduction and calculation: A Bendix G-15D alphanumeric computer uses the Oscar tape directly to produce the finished calculations.

4. Graphical data presentation: A Moseley digital X-Y Plotter system uses the computer produced tape to plot the indicator card.

To facilitate data collection in the field, all the necessary equipment has been mounted in a 16-ft house trailer. This is shown in *Fig. 1.* This trailer provides protection in the field for the instrumentation and ample working and storage space for personnel and supplies. The trailer contains its own power supply, an engine generator set. *Fig. 2* shows the recording oscillograph, vibration meter, carrier amplifier, pressure calibrating stand and other equipment as mounted in the trailer.

The trailer is located close to the test site, and after



By Paul A. Fedde and Robert H. Meyer,
Texas Gas Transmission Corp.,
Owensboro, Kentucky

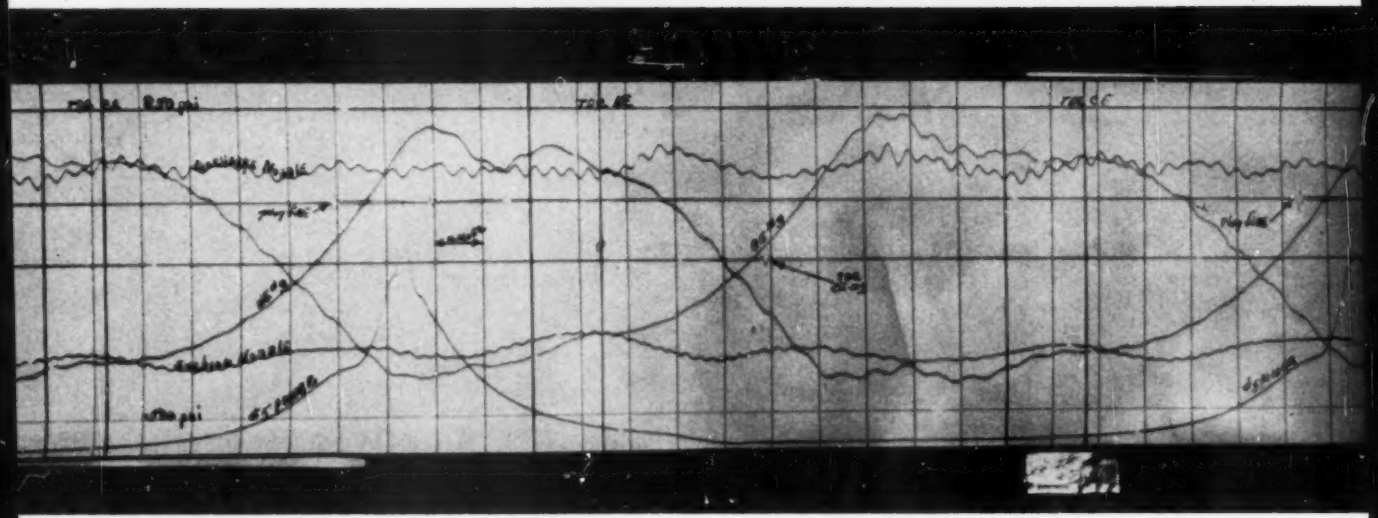


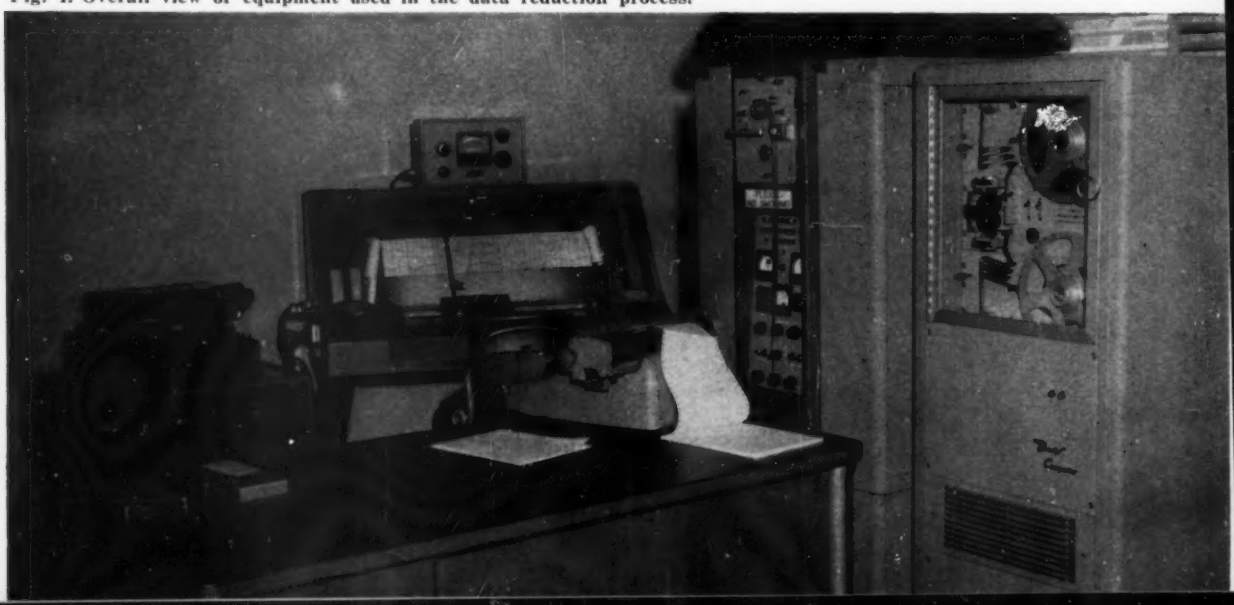
Fig. 3. Example of a record ready for processing.

the transducers have been calibrated and balanced they are installed on the compressor and the test run started. Pertinent data relating to the test are recorded on the data sheet for later use in the calculations. These data include such things as transducer pressure shift because of temperature, compressor pocket conditions and other related information.

An inductive pickup coil is used to indicate piston position (TDC, BDC, etc.) by generating a signal as small magnets placed on the flywheel pass under it. This signal is recorded concurrently with the pressure transducer signals and correlates the pressure information to the position of the compressor crankshaft. This signal is also used to calculate the actual speed of compressor. The completed records are automatically processed in the field and examined to insure that all the information is properly recorded. After a series of test runs has been made, the oscillograms are taken to the office for processing and analysis.

The processing begins by examining the test results, arranging them in the proper order and selecting appropriate cycles for the detailed analysis. An example of a record ready for processing is shown in *Fig. 3*. Notice the calibrating traces representing 500 and 850 psig on the record. The amplifier gain controls are set so that all the transducers conform to this calibration. These calibrating traces are also used in setting up the Benson-Lehner "Oscar," which does the actual analog to digital conversion of the pressure data. This record also shows the pressure wave of the adjacent power cylinder as well as the firing of the spark plug. The vertical lines are timing units that are automatically recorded by the oscillograph, the distance between adjacent lines representing 0.01 seconds.

Fig. 4. Overall view of equipment used in the data reduction process.



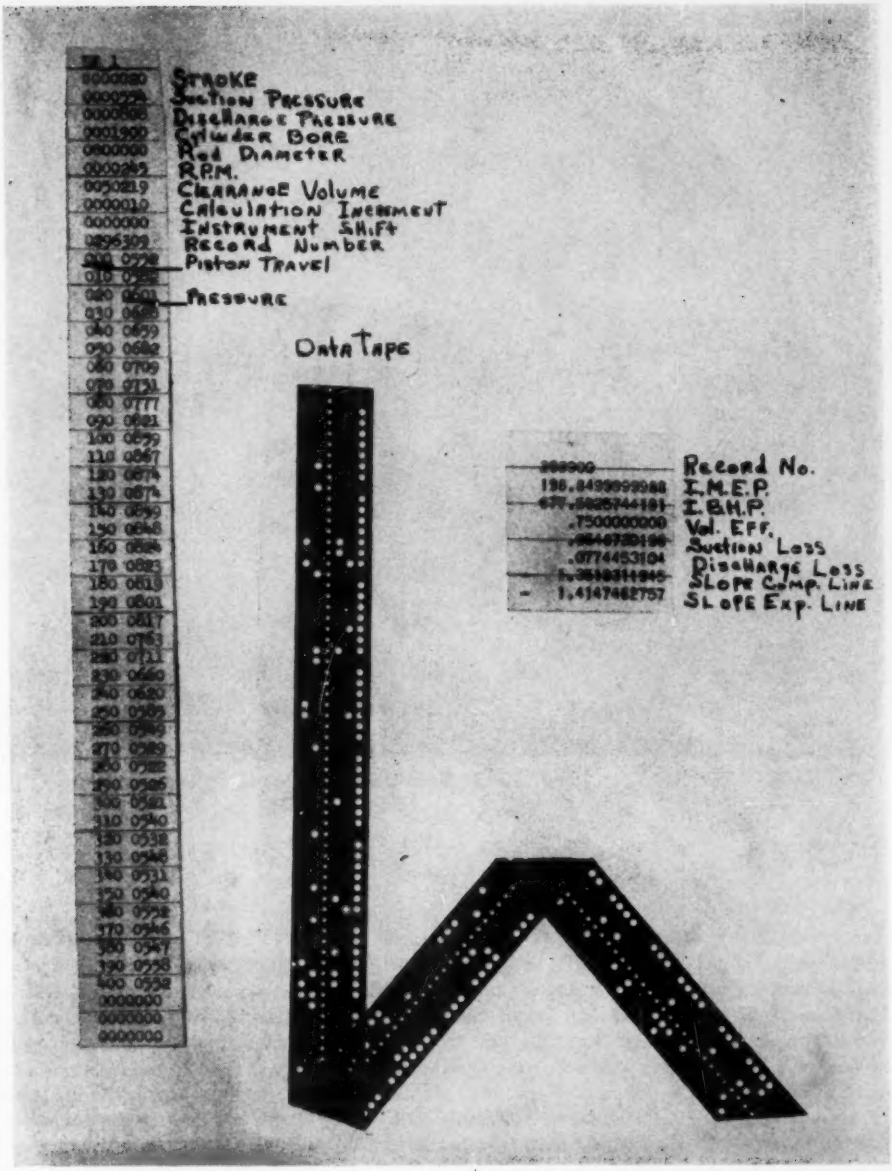


Fig. 5. Output from "Oscar."

An overall view of the equipment used in the data reduction process is shown in *Fig. 4*. In the foreground is the Bendix G-15 digital computer with its typewriter control unit and a magnetic tape unit. In the background is the Benson-Lehner Oscar, its control unit and the Flexowriter output unit. The Flexowriter produces a hard copy as well as a punched paper tape of the test results. A data tape is shown on the photoelectric tape reader of the G-15 computer. The computer program itself is stored in a paper tape magazine like the two shown on the desk in this picture. The meter shown in the top of Oscar functions as an expandable scale. When properly calibrated it affects the time to displacement conversion that is necessary before any horsepower calculations can be made. This displacement meter derives its signal from a high precision linear potentiometer which rotates as the Oscar carriage is moved. The meter scale is replaceable and individually calibrated for each make and model of compressor engine that we test.

The principle on which Oscar is designed is quite simple, but it does an excellent job when it becomes necessary to digitize information that is presented in analog form. Its operation is quite simple. The left knob on the carriage moves the carriage so as to position a vertical line over the desired point. Then the right knob is turned until the line on the slanting plastic arm intersects the vertical hairline and the desired point. The readout control button, which is positioned between the carriage control knobs, is pushed and the digital value of the desired point is typed by the Flexowriter and also punched into paper

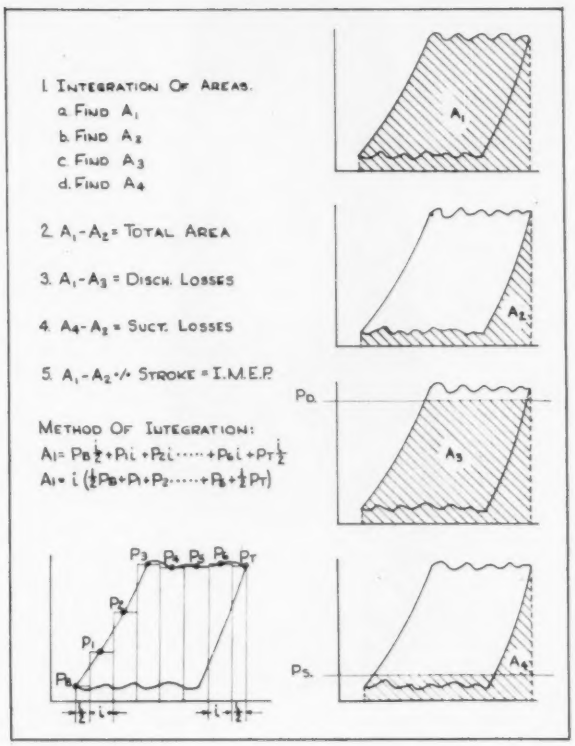
Fig. 6. Data tape being read into computer.

tape at the same time. The Oscar is calibrated by changing the slope of the small plastic arm until the desired values for the calibrating lines are obtained. The stroke indicator that sits on top of Oscar tells the operator where to position the carriage to read out the pressure that corresponds to the desired piston position.

The output from Oscar is shown in *Fig. 5*. The first 10 lines of numbers are entered manually by using the Flexowriter keyboard. This is the information required by the computer in order to process and calculate the test results. The long line of numbers after the record number is the actual Oscar output and shows the pressures that exist in the compressor cylinder at each position of the piston. Notice that the total piston travel shown by Oscar is equal to twice the stroke of the compressor. This is due to the nature of the "pressure-time card" from which the information is read. The computer, of course, corrects for this in the calculation. The entry entitled "Instrument Shift" on the data tape corrects the data for known pressure shifts of the active transducers should this be necessary. This is caused by operating temperatures being different than the calibrating temperatures. This correction is applied by the computer when it processes the data tape.

The resultant data tape, when used as input for the computer programs, produces the record shown after taking 20 to 90 seconds to calculate and type the results. The calculation time depends on the number of increments used. *Fig. 6* shows the data tape being read into the computer. For each calculation, the operator has the choice of either entering the data manually or reading it in on punched tape.

After receiving the horsepower data, the program converts all of the information to binary, clears the various accumulators, and proceeds to calculate the necessary areas by numerical integration techniques. *Fig. 7* shows the four areas the program calculates. Notice that all of the areas are calculated to the zero pressure axis. Because the ease of performing a numerical integration is not one of the factors considered when choosing the stroke of our compressor engines, we decided that the numerical integration technique must not be one that specified an odd or even number of increments. Who likes to work in terms of 2/3 in. of piston travel or any other such odd increment? Since our method of always using the "X" axis for one boundary of all the areas assures us of a straight edge, we just calculate our incremental areas as if they were rectangles. *Fig. 7* shows the method of doing this for calculating area A_1. Areas A_2, A_3, and A_4 are calculated in the same manner. This method allows us to use either an odd or even number of increments, the only restriction being that all the increments must be equal. These areas are combined in the manner shown in *Fig. 7* to give us the desired areas. With this treatment of computing the areas, we read the pressures


1. Integration Of Areas.
a. Find A_1
b. Find A_2
c. Find A_3
d. Find A_4
2. $A_1 - A_2$ = Total Area
3. $A_1 - A_3$ = Disch. Losses
4. $A_4 - A_2$ = Suct. Losses
5. $A_1 - A_2$ ÷ Stroke = I.M.E.P.
Method Of Integration:
$A_1 = P_B \frac{1}{2} + P_1 i + P_2 i \cdots + P_6 i + P_T \frac{1}{2}$
$A_1 = i\left(\frac{1}{2}P_B + P_1 + P_2 \cdots + P_6 + \frac{1}{2}P_T\right)$
A_1
A_2
P_D
A_3
P_3 P_4 P_5 P_6 P_T
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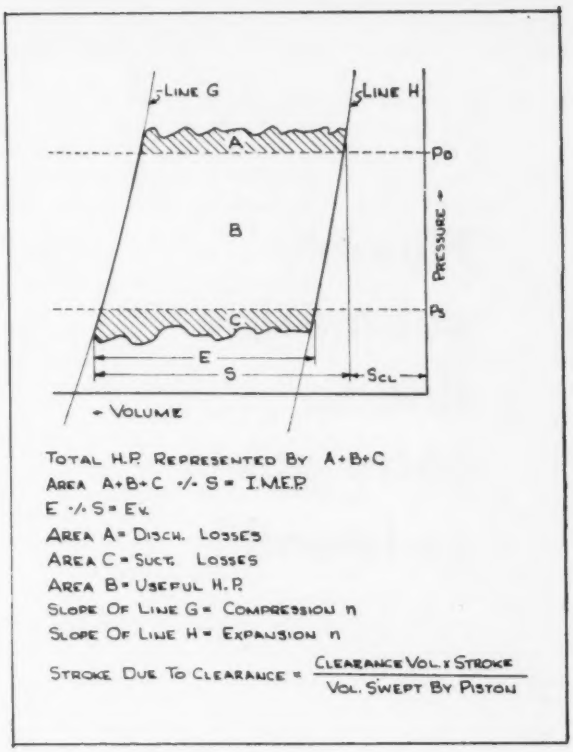


Fig. 7 (left): Four areas calculated by the program. Fig. 8 (right); Calculation of the slope of compression and expansion lines.

corresponding to ½- or 1-in. increments of stroke.

We find that using 1-in. increments of stroke on compressors with a stroke of 14 in. or more will give us satisfactory accuracy when calculating the IMEP or IBHP. However, to get good values for the slope of the compression and expansion lines as well as for what we define as suction and discharge losses, we feel that it is necessary to use ½-in. increments of stroke. We have not been able, under any conditions, to justify the use of stroke increments of less than ½ in. for large compressors.

In an attempt to measure how good a piping match we have between the compressor and the piping system, we have arbitrarily defined areas A and C in *Fig. 8* as the discharge and suction losses. This is expressed as the percentage relationship that "A" and "C" bear respectively to the total area of the card, i.e., A + B + C. The pressures indicated as P_s and P_d are the average dead weight pressures as measured in the suction and discharge nozzles of the compressor cylinder during the test run.

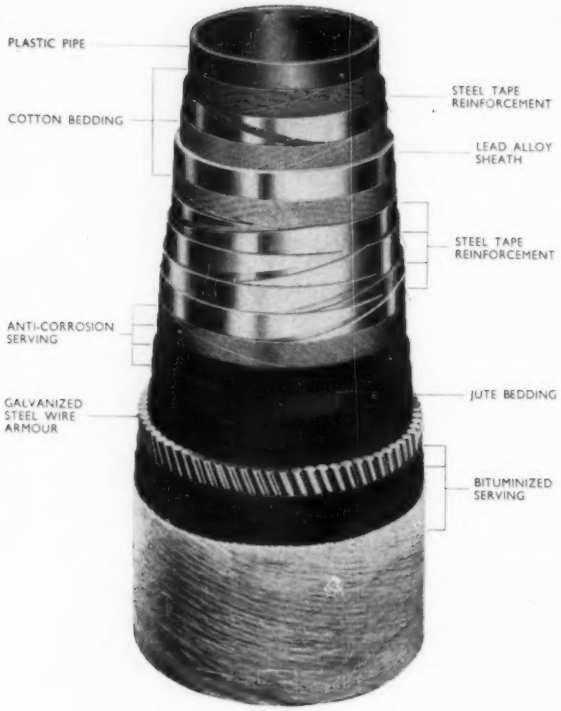
The apparent volumetric efficiency of the cylinder is obtained by comparing the length of the stroke remaining, "E," in the expansion and suction cycle when the pressure first becomes less than P_s, to the total stroke of the compressor, "S." A comparison of the calculated V_c and the apparent V_e serves as a good guide to the validity of the test results, i.e., whether valves were leaking, etc.

The calculation of the slope of the compression and expansion lines, lines G and H respectively, is the most complicated part of the computer program. For this part of the program the physical stroke of the compressor must be increased by an amount necessary to displace the volume due to the cylinder clearance. This is indicated by the distance S_{cl} in *Fig. 8* and is calculated as shown. The calculation of the slope of the compression line uses all of the points between BDC and P_d. The expansion curve calculation uses all the points between TDC and P_s. The program takes the log of the pressures and of the adjusted stroke, then by means of a least square's fit calculates the slope of the line. We find the slope or "n" value as calculated to be very sensitive to poor mechanical performance of the compressor as well as to inaccurate data reduction techniques. A suspicious "n" value, $1.2 > n > 1.4$, for the usual 0.6 gravity, 1020 Btu natural gas, points to one or more deficiencies in the test data or the calculation of the data.

This data reduction and calculating equipment has allowed us to process up to 20 sets of data a day compared to about two by the use of manual techniques. This rapid and accurate data handling enables us to provide our operating departments with complete and accurate information on which to base their decisions. ■

This article is adapted from a talk presented at the May 1961 Compressor Roundtable Conference held in Kansas City, Mo.

Flexible submarine line to carry gas to island



FLEXIBLE SUBMARINE GAS PIPE

Cutaway view of section of the flexible submarine pipeline which will pipe natural gas to Vancouver Island.

Natural gas will reach Vancouver Island industries about the end of 1962. It will come from the British Columbia mainland. The "pipe-line" will be the world's longest flexible submarine pipeline, according to contracted plans of Magna Pipe Line Co. Ltd. of Vancouver. Twin submarine sections of the flexible pipe each about 19.5 miles long, will be laid across the bottom of Georgia Strait between Ladner (at the estuary of the Fraser river) and Westholm, on Vancouver Island, traversing Galiano Island, Trinconali Channel, Saltspring Island, and Stuart Channel. From Westholm, the line will be extended on land, southward to Victoria and northward to Nanaimo. The land sections of the pipe will be of conventional rigid steel construction.

Financing of Magna Pipe Line Co. is under way. It will receive some $5.5 million from the sale of 225,000 shares to Canadian investors. Another 525,000 common shares (without par value) will be offered for sale by underwriters in the United States. The company is now listed on the stock exchanges.

The submarine sections will be of 4.85-in. ID, composed of an inner mirror-smooth core, with steel tape reinforcement, lead alloy sheathing, and galvanized steel wire armor. The OD will be about 7.5 in. Total length of the twin lines from Ladner to Westholm will be about 53 miles.

The pipe or cable fabrication has been started by British Insulated Callenders Cables Co. Ltd. at Manchester, England, under a $7 million contract with Magna. The submarine section will be continuous and will be laid by a specially equipped ship to be chartered by a subsidiary company, British Insulated Callenders Construction Co. The pipelaying ship, to be named "Photinia," is being built in Scotland.

The new Vancouver Island pipeline will connect to supply lines of Westcoast Transmission Co., near Ladner. A contract signed by Magna Pipe Lines on Nov. 30, 1960, calls for the daily supply of natural gas via Huntington, B. C., at a monthly demand rate of $3.20 per Mcf, plus a commodity charge of 20 cents per Mcf of gas delivered up to the dates of contract demand, and providing a maximum commodity charge of 37.5 cents. The term of the contract is 20 years.

The BICC flexible pipe is designed to operate at 1500 psig. Compression installations up to 1964, near Ladner, will provide a line capacity of 31.8 MMcfd under about 1033 psig at Ladner.

In 1965 a further extension of the Vancouver Island land line from Nanaimo northward to Port Alberni and Campbell river, and another short submarine section to Powell river, a paper-mill town on the mainland, is planned to serve forest industries.

In all, 29 (linear distance) miles of submarine line and 115 miles of land line will be constructed by 1967. This will necessitate the addition of more compression

to raise the supply capacity to 68.9 MMcfd, under pressure of about 1295 psig.

The total cost of these two projects will be about $24 million.

Land installations for the initial section of submarine pipelines, and land lines on Vancouver Island between Victoria and Nanaimo, will cost about $7 million, which, with the submarine lines themselves, also $7 million, will bring the total cost of the first part of the Island pipeline to $14 million. The extension to Campbell River and Powell River will involve the expenditure of another $10 million, starting in 1967.

(A merger with Natural Gas Transmission Co., of Seattle, Wash., contemplated by Magna Pipe Lines, would add another $6 million in costs of construction of a pipeline NGT is building to serve the Olympic peninsula in Washington state, opposite the southern tip of Vancouver Island.)

Meanwhile, sea trials of a section of the submarine pipe being made for Georgia Strait were carried out by BICConstruction Co., in October, in the Mediterranean Sea area. The submarine pipe is to be carried in a continuous coil in the hold of the ship rather than on deck.

The Vancouver Island submarine pipeline development is the result of study of the pipeline made for wartime "Operation Pluto" to carry gasoline under the English Channel during the 1944 invasion of Normandy. The BICC Company and associates made that invasion possible and were probably largely responsible for its successful progress toward ultimate success on the beaches. Landing craft had to be kept supplied with fuel. The heroism of the landing forces accomplished the rest.

More recently, a shorter length of flexible submarine pipe was laid across a river bay in Texas, and proved to be capable of transmission of gas under the same pressures as those planned for the Vancouver Island line.

It is notable that the maximum depth of the channel in the Strait of Georgia, between Ladner and Westholm, is 810 ft.

The route of the submarine pipeline will be almost parallel to the 135-mile-long high-voltage submarine power cables laid by the BICC Company in 1956 and 1958.

Each of the continuous submarine pipe sections will be subjected to stringent tests to prove their ability to transmit up to 50 MMcf of natural gas in 24 hours. This is equal to 750,000 hp of 560 megawatts electric power, or the output of a large generating station.

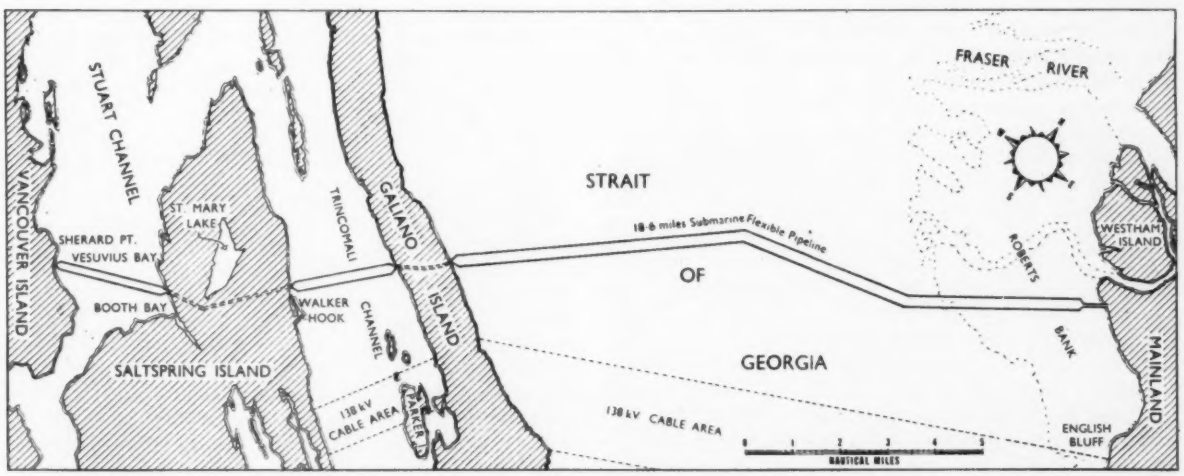
Consulting engineers engaged to design the engineering features of the Vancouver Island submarine line and shore installations are International Power & Engineering Consultants Ltd., of Vancouver, B. C. Their plans are well advanced.

President Ralph K. Farris of Magna Lines Ltd., has stated he is confident the new natural gas supply to Vancouver Island will give a big boost to the industrial development of the island.

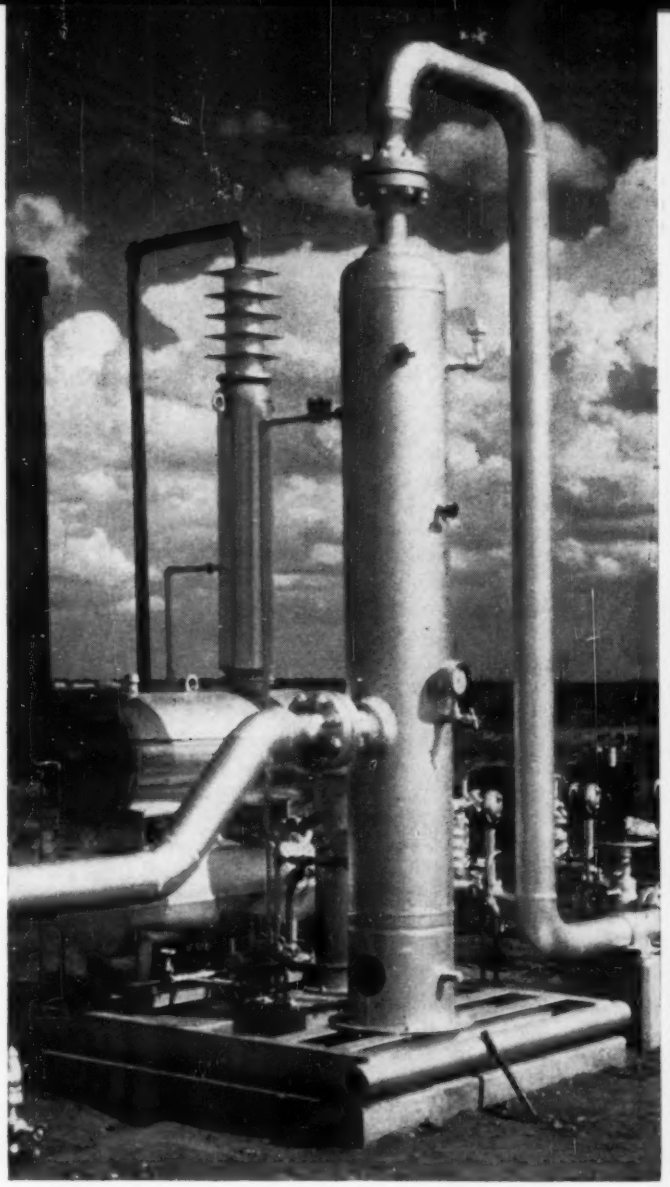
British Insulated Callenders Cables Ltd. executives in England declared that the contract with Magna Pipe Lines Ltd., "held tremendous potentialities for Britain" in future manufacture of submarine pipelines.

From a purely mechanical or physical point of view, the BICC Company regards the use of the flexible submarine pipe as economically desirable for many reasons: It can be laid faster than steel pipe; costs less to install because no welding is required to join numerous short sections together; it takes the contour of the sea bottom, and is less subject to stress and breakage; the laying operation can be done from a single ship. The heavy insulation and armor protect the pipe from corrosion. It may be expected to outlast the life of steel pipe of the same diameter by many years, under the same salt water submersion.

The BICC Company contract with Magna Pipe Lines Co., Ltd., calls for completion of the Georgia Strait submarine lines by July 31, 1963, but Magna is confident that installation can be completed before the end of 1962. Land sections will be built during the early part of 1962 and are expected to be completed in time to bring the natural gas supply to Vancouver Island consumers by the first few months of 1963. ■



Proposed route from British Columbia mainland to Vancouver Island.



An 85-deg F dew point depression glycol dehydration unit in west Texas.

100 deg F dew point depressions

with glycol dehydration

By CHARLES R. PERRY • Sivalls Tanks, Inc.

FOR many years glycols have been used for removing water vapor from natural gas in both wellhead- and plant-size absorption-type dehydrators. However, they were limited to applications where dew point depressions of less than 75 deg F were required and to outlet water contents of 5 to 7 lb per MMcf.

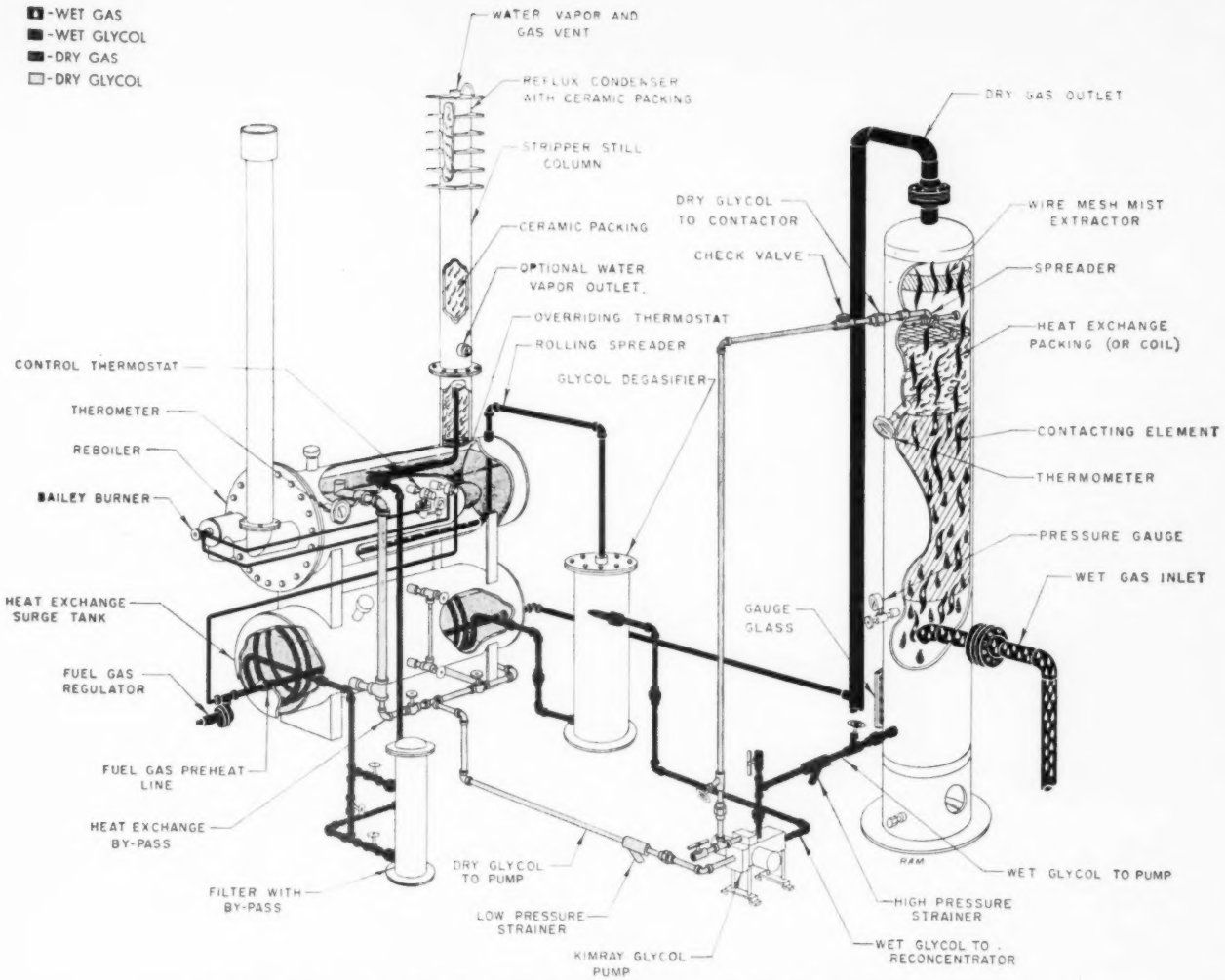
Gas process engineers realized some time ago that higher dew point depressions would be obtainable if the glycol could be reconcentrated to a higher purity. On some plant-size units, the regeneration facilities were equipped with either vacuum pumps or ejectors —to hold a vacuum on the reboiler and stripping still to remove more water from the dry glycol. This proved to be quite satisfactory for large, fully attended units, but was not practical for the thousands of wellhead dehydrators which operate unattended.

About three years ago, several manufacturers started building and guaranteeing wellhead glycol-type dehydration units for dew point depressions up to—and sometimes in excess of—100 deg F. These units were discussed briefly in various technical meetings in 1959, and process design data was published in 1960.[1] Although specific details on their design have not been published, it is almost certain that all manufacturers are obtaining the necessary dryer glycol by gas stripping the rich glycol in the regeneration step of the process.

HOW IT IS DONE

In a typical conventional glycol-type dehydrator, dry triethylene glycol—reconcentrated to between 98 and 99 per cent purity by weight—is pumped into the top of a vertical absorber column. There, it drains by gravity down through some type of contacting element —either trays or packing—and is contacted countercurrently with the gas stream being dried. The glycol, being highly hydroscopic, will absorb all but a few parts per million of the water vapor in the gas.

The wet glycol in the base of the column is dumped through: some suitable level-control device, a heat exchange-surge tank (countercurrent to the regenerated glycol), a filter, and then into a short still column, usually mounted on a reboiler kettle. Air cooling fins at the top of this column provide sufficient cooling for adequate reflux. The rich glycol then drains into the reboiler kettle, where the temperature is raised to 350 to 400 deg F. That boiling point, curves indicate, will provide dry triethylene glycol concentrations of 98 to 99 per cent. The lean glycol then drains by



A flow diagram of a typical glycol dehydrator designed for high dew point depression. The excess gas passed by the Kimray glycol-powered glycol pump is used as stripping gas.

gravity into a surge tank, is cooled, and recirculated to the absorber.

In a unit designed for high dew point depressions by gas stripping glycol, virtually the same equipment is employed. There are two exceptions: (1) A small amount of gas is injected continuously into the reboiler to strip more water vapor out of the glycol. (2) More contacting element is employed in the absorber column to reduce the overall glycol circulation rate required.

The way in which the stripping gas is injected is the key to gas stripping glycol. Many different techniques apparently are used by various manufacturers, and all appear to be reasonably successful. Although exact details on gas stripping have not been disclosed by any manufacturer, stripping gas rates of 3 to 10 cu ft of gas per gallon circulated will provide dry triethylene glycol concentration of between 99.5 and 99.8 per cent with proper design. Stripping gas may be supplied from any convenient source, such as the fuel gas system, or excess gas passed by a glycol-powered glycol pump.

For high dew point depression glycol dehydrators, absorber columns containing eight or more trays are frequently seen. This abnormally high number of trays allows the units to be design-based on as low as 2 to 3 gal. of glycol circulated per pound of water in the incoming gas.

HOW THEY PERFORM

After three years of field operation, large amounts of performance data have been collected to indicate the practicality of high dew point depressions with glycol dehydration. Typical data, from 10 units of various sizes and operating under a wide range of conditions, are shown in the accompanying table. These units were all design-based on dry glycol concentrations of 99.5 per cent triethylene (3 to 5 cu ft of stripping gas per gal.), and the absorbers contained 1 to 1.5 theoretical trays.

Data from the table have been plotted in *Graph 1* as "Outlet Dew Point" versus "Contact Temperature." This shows good correlation, and indicates that an increase in dew point depression is obtainable with an increase in contact temperature. The chart, then, fur-

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Steel

TYPICAL FIELD PERFORMANCE OF GLYCOL DEHYDRATORS DESIGNED FOR HIGH DEW POINT DEPRESSION

Unit No.	Contact Temp. °F.	Outlet Dew Point, °F.	Outlet Water Content lbs./MMCF	Dew Point Depression, °F.	Loading, MMCFD	Glycol Rate, GPH	Operating Pressure, PSI	Glycol Rate, Gals./lb. Water
1	70	+ 2	2.8	68	3.7	28	770	6.0
2	68	− 2	2.4	70	3.2	24	835	6.7
3	64	− 5	1.8	69	1.9	12	835	6.6
4	80	− 7	1.8	87	1.9	14	815	4.4
5	79	0	2.5	79	2.2	24	815	6.7
6	80	+ 1	2.6	79	1.6	28	815	10.5
7	82	+ 4	2.8	78	3.6	36	825	5.7
8	70	0	3.8	70	—	22	400	—
9	117	+10	3.1	107	8.4	72	960	3.8
9	114	+ 6	2.5	108	9.9	72	965	2.8
9	109	+12	3.5	97	9.9	72	960	3.0
10	94	+ 4	3.3	90	9.3	50	1020	2.6
9	96	+ 6	3.6	90	5.2	63	1000	5.6
9	108	+15	4.9	93	12.5	72	930	2.0
9	108	+12	4.6	96	12.5	72	930	2.0
9	109	+13	4.7	96	12.4	90	930	2.4
9	109	+11	4.5	98	12.4	74	930	2.0

ther confirms previously published data.[2]

Data from the table also were plotted in *Graph 2* as the "Outlet Gas Water Content" versus "Contact Temperature." While this correlation is not as good as that in *Graph 1* it still indicates the increase in outlet gas water content with increasing contact temperature.

These data were chosen as typical for average uniform design conditions. Experience has indicated that these dew point depressions may sometimes be improved either by more glycol circulation or more contacting element in the absorber. All could be increased by the use of more stripping gas in the stripping mill.

CONCLUSIONS

Dew point depressions of up to 100 deg F or more are not only possible, but are quite practical with glycol-type dehydrators. These units are subject to a few practical limitations:

1. In general, it is not practical to design a unit for lower than 0 deg outlet dew points. This means that 100 deg F dew points are practical only when the contact temperature is above 100 deg F.

2. It is difficult to consistently provide outlet water contents in gas of less than 2 to 3 lb per MMcf. This may be because the concentration of water molecules in the gas at the 2-to-3-lb-per-MMcf level is so low that the mathematical probability of a molecule of water contacting the glycol is virtually nil, no matter how dry the glycol.

3. If vacuum regeneration is not employed, a small amount of stripping gas is required to provide the necessary extra dry glycol for high dew point depression. Also, more contacting element in the absorber, or a higher glycol circulation rate may be required.

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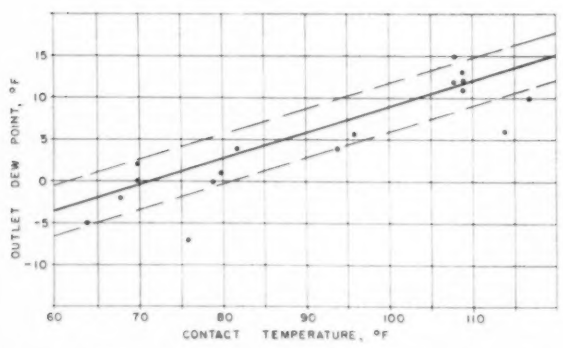
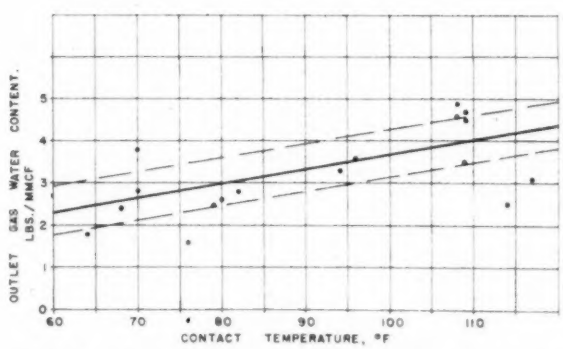
(1) Perry, C. R., "How to Design Glycol Dehydrators for 100 deg F Dew Point Depressions," *The Oil and Gas Journal*, Aug. 8, 1960.

(2) Polderman, L. D., "Equilibrium Dew Points in Natural Gas-Glycol Systems," *The Oil and Gas Journal*, July 25, 1955.



Graph 1. Effect of contact temperature on outlet gas dew point.



Graph 2. Effect of contact pressure on outlet gas water content.

C. C. Ingram
Oklahoma Nat

C. H. Jenkins
Gas Service

M. A. Washabaugh
Equitable

R. L. Melaney
Equitable

William Hill
Sprague

George Bell
Sprague

GAS·PEOPLE

C. C. INGRAM has advanced from vice president of Oklahoma Natural Gas Co.'s land and geological department to executive vice president of the company. JACK B. ELEY, superintendent of the land and geological department, succeeds Ingram as vice president of the department. Ingram joined Oklahoma Natural in 1940.

MERLE A. WASHABAUGH has been named director of the industrial and commercial sales department of Equitable Gas Co., Pittsburgh. He succeeds PAUL W. CRAIG, who has retired. RALPH L. MELANEY succeeds Washabaugh as supervisor in the department.

WILLIAM A. HILL has assumed the post of regional sales manager of Sprague Meter Co.'s newly formed central sales region, headquartering in Kettering, Ohio. The region encompasses Michigan, Ohio, Indiana, Illinois, Kentucky, West Virginia, and western Pennsylvania. GEORGE H. BELL, headquartering in Columbus, Ohio, will work with Hill as a sales engineer.

RICHARD T. SIGMUND has been appointed manager of public relations for South Jersey Gas Co., Atlantic City. Sigmund has been public and employee relations assistant since 1958.

CARL H. JENKINS has been promoted to general sales manager of the Gas Service Co., Kansas City, Mo. He succeeds FLOYD M. ROSENKRANS, who has retired after 48 years' service.

BLAYNE SALYER has been named to the post of product publicity manager in Crane Co.'s corporate marketing headquarters in New York.

WALLACE E. HERTEL, engineer at Berkshire Gas Co., Pittsfield, Mass., since 1954, has been elected assistant vice president for engineering.

WARD M. ROCKEY has joined Washington Natural Gas Co., Seattle, as director of public relations. He formerly was manager of the Centralia (Wash.) Chamber of Commerce.

JOHN GRIBBEL, II, has been elected a director of American Meter Co. Gribbel, a partner in a Philadelphia investment house, was formerly Philadelphia district manager for American Meter. He is the grandson of the late John Gribbel, Sr., who was instrumental in organizing the present-day American Meter Co.

WALTER A. MCDONOUGH has retired as vice president, controller and director of Northern Indiana Public Service Co., Hammond, Ind. McDonough, who has completed more than 50 years of service in the public utility field, also resigned from NIPSCO's board of directors. ALLAN P. GOOD succeeds McDonough as vice president and controller. CARL D. REES, first vice president of NIPSCO, succeeds McDonough on the board of directors.

ARNOLD E. HEISE has been named superintendent of gas service in the San Francisco division offices of Pacific Gas & Electric Co. He succeeds GEORGE E. BROWNING, who retired after 50 years' service. RICHARD K. MILLER has been promoted to administrative assistant to division manager HARRY A. LEE. Miller succeeds ELLIS LARKINS, who is now manager of the business office.

HAROLD R. BILLUPS, southeastern district industrial engineer for Ohio Fuel Gas Co., has transferred to a similar post in OFG's Lake Erie district with headquarters in Norwalk.

QUENTIN GALLIVAN, Midwest regional sales manager, is in charge of the district sales and service office opened recently in Chicago by Kraloy-Chemtrol Co., Santa Ana, Calif.

Continued on page 116

DEWSCOPE

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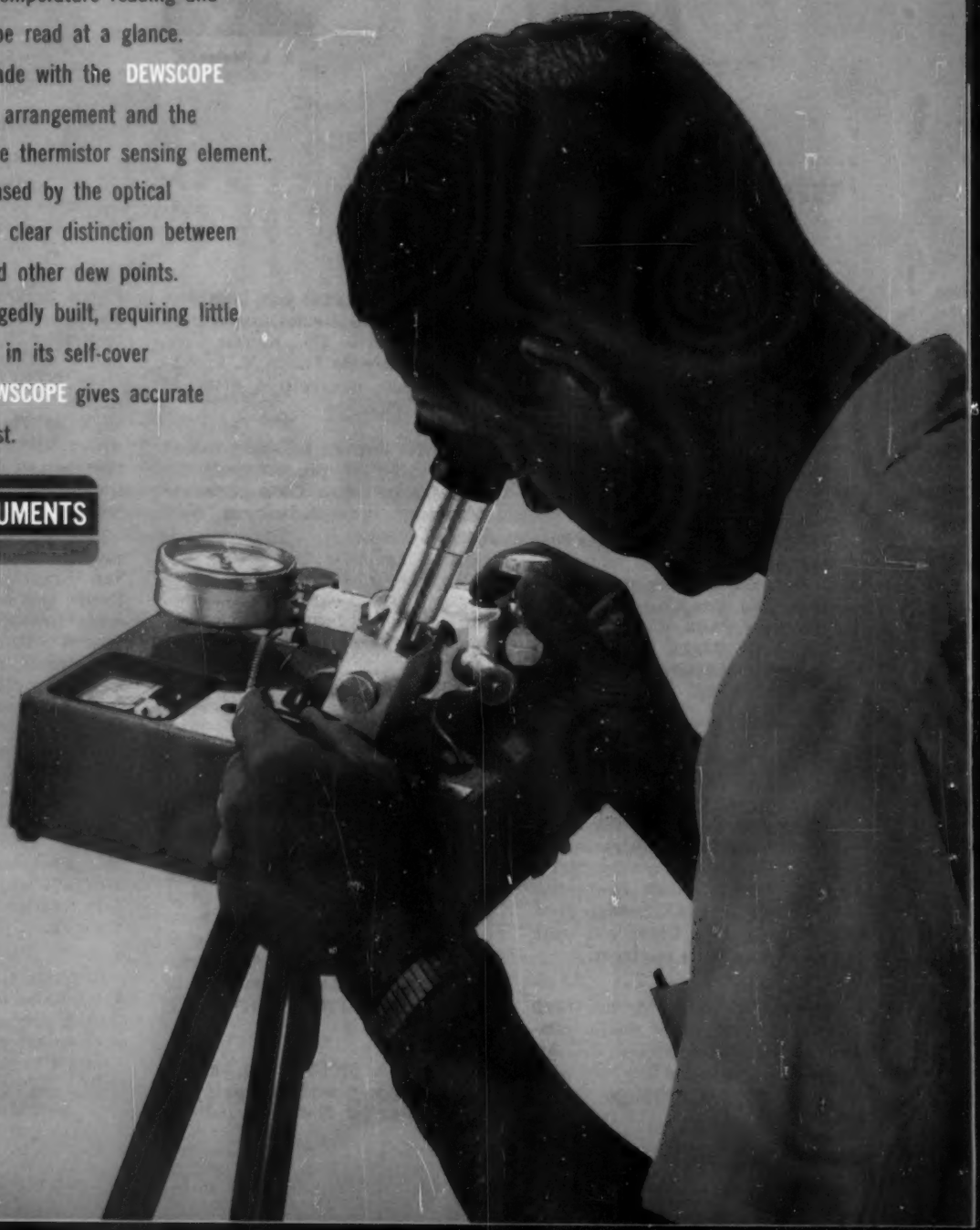

BY KEN KRIDNER • Engineering Editor

Management and measurement

HOW concerned are management and regulatory agencies in having accurate gas measurement? I am certain every person responsible for gas measurement has thought about this subject.

So let's talk about accuracy this month. Not accuracy at any single point or of any single item in handling natural gas—but about accuracy from the standpoint of attitudes of persons in various activities in the gas industry.

You may well say that a cubic foot of gas is simply that—a cubic foot of gas but nay, 'tis not so easy to dismiss this subject. For a cubic foot determination depends upon conditions in the contractual agreement, and encompasses pressure base definition, application of correction factors and procedures for performing quality tests. It goes yet a step further, to the desire and intent of the party concerned for an accurate determination of volume passed. Accuracy, or the need for accuracy, in gas measurement is not viewed in the same light by the producer, transmission company, distributor, and consumer.

Well, why not? We are told that everyone should try to do a job right if we are to do it at all. And here we see the bug-a-boo that has always confronted the measurement supervisor conscientiously striving to do a good job—to improve the accuracy of measurement. For want of a better phrase, let's call it "Management Attitude" or lack of interest by management in accurate gas measurement. But why not look at the cubic foot of gas as it passes along the line?

Producer:

If you will review statistics available on natural gas production for the past several years, you will find that the majority of our natural gas has come from properties held by companies that also produce crude oil. In most instances you will find that until recent years these companies looked on their natural gas wells and sale of gas from such wells as side operations. In other words, these companies were primarily interested in crude production and sale of petroleum products.

So it is not mystifying that these companies failed to place much emphasis on accurate gas measurement. Couple with this the fact that majority of their gas sales were at low flow rates and it is easy to see why field measuring stations were designed to minimum specifications. Equally, it is easy to visualize volume computations using a maximum of assumed quality conditions.

But the producer that assumes protection through the rule of compensating errors can be in for a rough ride. Though it is true many assumed values will cancel their own inaccuracies, there is also such a thing as an additive error. The producer (and as you will see later, the consumer) occupies the position of benefitting most from accurate measurement. Conversely, he stands to lose the most through inaccurate measurement. Although the price per Mcf paid producers is subject to regulatory action, the number of cubic feet metered is dependent solely upon the accuracy of the measuring device used. Faulty or improperly designed and operated metering devices can, and most likely will, result in moneys absent from the bank account of the producing company.

And a cubic foot passed but not recorded properly is never reflected on the payment check.

It is imperative that a producer conduct his measurement operations so that all gas produced is metered accurately. Think back, if you will, to producer attitudes on meter station construction, instrument checking and verification of chart calculations.

Transmission

The reader may say, does not this philosophy carry over into the operations of the interstate transmission company? No. Here we see a different attitude in gas measurement. The transmission company purchases gas from producers and sells to distribution companies with some direct industrial sales. Rate bases are determined and established by FPC and take into consideration a number of variables. We see the regulatory body approve contractual arrangement with producers. We see rates for gas sales to distributors set by the regulatory body.

Thus, a transmission company finds itself in the middle of a two-edged sword attack—but the sweeping action of both edges misses the transmission operator. The regulatory body in its oversight of interstate gas activity constantly surveys transmission company annual reports to assure that companies not exceed the approved rate of return.

But how, you ask, does this have a bearing on measurement? To be sure it does. Though to date we find the most accurate measurement in the transmission group, it is here that oversight could be tolerated. Rates of return and rates are established as functions of plant investment; accurate gas flow rates are secondary to the relationship. For the transmission company, inaccurate measurement

(*Continued on page* 104)

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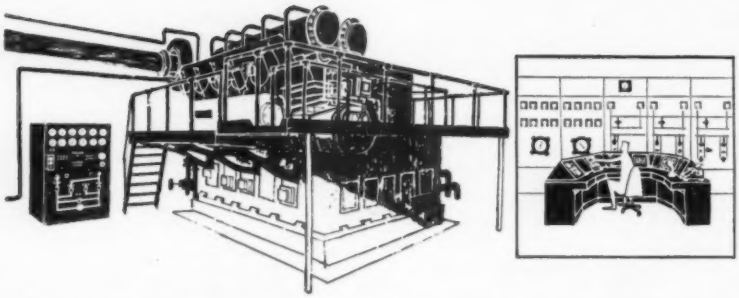

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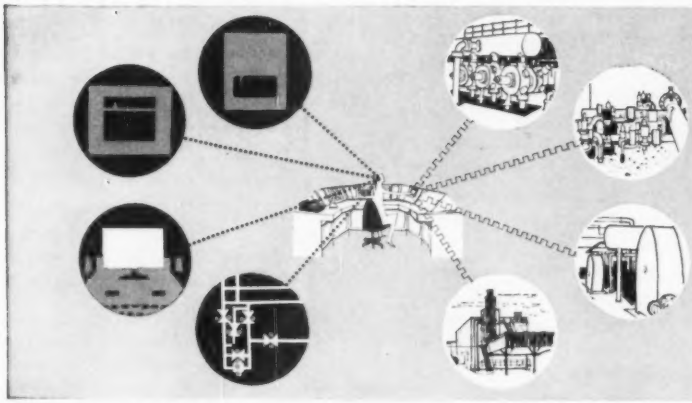

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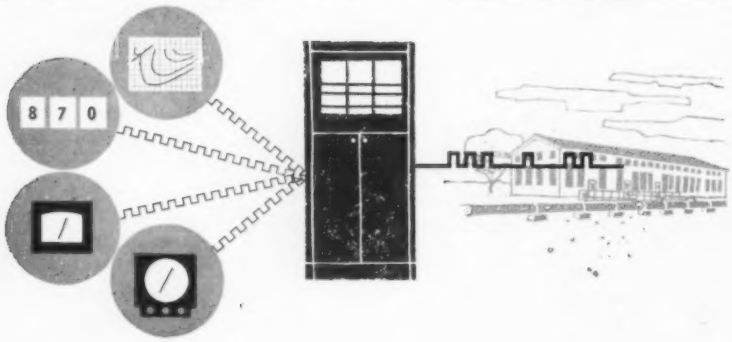

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Communications Tele-Control

By F. VINTON LONG

New Trends in Telemetering

For many years we have sort of rocked along with telemetering techniques which originated with electric power and oil and gas industries, to provide a simple means to transmit information from a remote point to a control center.

This requirement was fulfilled by the several basic types of telemetering transmitters and receivers which are of sound design and which we expect will carry out their duties for many years to come. I refer to the analog techniques and if you get right down to it, it is pretty hard to beat this instrumentation for a simple, foolproof method of telemetering, and I doubt if this equipment will ever be replaced for other types in many instances.

However, with the advent of the computer boys and the military development of telemetering techniques, there are some cases in which we may well look as to what we may do now and in the future to efficiently employ the latest available equipment.

Some of this equipment is here and some is not. As an example, we would like to have a direct digital readout pressure transducer with good accuracy which we could plug into a telemetering circuit to provide digital readout and computer input. That this is a handy gadget, I refer to the National Inventor's Council list which indicates that such a gadget would be of value to the military if some smart engineers such as you could get busy and dream one up. This digital output pressure transducer could be used for in-station control of an automatic compressor station, as well as to provide information for transmittal to a distant control center.

A necessity for the gas companies is some sort of flow indication from which a pipeline can be observed and controlled, and eventually used as a source of automatic billing.

The mass flowmeters now available from several companies can provide this information, but for a variety of reasons have not received common acceptance with the pipeline companies. However, there are in operation several very workable installations using conventional orifice plate information with local computing equipment which will provide analog computation, and which with analog-to-digital converters can be transmitted digitally for long distances to a control panel or a computer. An example of this is The Peoples Natural Gas installation which includes analog computation of corrected Q with digital transmission of the data from the remote stations to the dispatch center. This has been most adequately described in a paper by Walter Rufleth on the instrument Society of America conference on Sept. 11, 1961, and is covered in their paper No. 126-LA-61.

While on the subject of analog-to-digital conversion for telemetering purposes, there is no reason why the analog values cannot be transmitted on slow speed communication circuits to a communication subcenter containing several remote points, convert them to digital data on a programmed or on-call sequence, and transmit this information in digital form to a control center which also might contain a computer.

Also while on this subject, I might mention that there is a device originally developed by FAA for control tower use in readout of barometric pressures which might be useful in some cases to your industry. This device uses a light sensing transducer which mounts on the face of an existing instrument and through a transistorized black box, converts it to a digital output. I believe that one strong application of this device might be in the interpretation and transmittal of kw meters for the power industry, inasmuch as no electrical or physical contact is required with the meter, and I understand that such meters are not receptive to the mounting thereon of encoding wheels or other gadgets. It could also be used to read on line gauges without tampering with the instrument.

Concerning the communication links to carry telemetered intelligence, I believe that the FCC will assist the power and the oil and gas industries in working out methods whereby radio links can be used efficiently, and I believe that transistorized radio equipment can be employed for this duty in such a manner that it is not affected by commercial power interruptions. With this device a small battery is kept charged from commercial power, but the equipment stands ready to function at any time from the battery alone in the event that loss of such power occurs.

Also I believe that low frequency microwave channels will be used extensively as telemetering links for this service.

I have the feeling that somewhere in the electrical power industry there is need for such techniques; also at the risk of being declared *persona non grata* by the electrical power men, Texas Instruments is working on a *gas-fired*, thermoelectric generator-powered microwave telemetering

(*Continued on page* 104)

* Talk given before Houston Section, AIEE—Oct. 24, 1961.

M-A-C • Continued from page 101

would reflect itself in the books of the company as a shortage of income from gas sold or as a shortage of payout for purchased gas. In either case, the permitted rate of return would act as a compensating agent and the regulatory body riding herd on company operations would be requested to approve rate adjustments to give the approved return. Thus, we may see instances where management of a transmission company fails to be too concerned by the quality of its measurement operations.

To be sure this attitude is not universal with management of transmission companies. This group as a whole is to be highly commend for efforts to improve measurement standards.

Distribution

Here, again, we see an area where interests are safeguarded (?) by a regulatory body, though here the controlling agency is a state or local body. In this instance, emphasis is shifted from the purchasing meter (the one on the sidegate or tail-end of a transmission pipeline) to domestic meters at homes of consumers. We note absence, in most cases, of temperature compensation on the domestic type meter though many are exposed to the elements. System losses can be high—but again we see company interest protected by rate of return, state or local version. Here we may again find management failing to give proper consideration to accurate metering.

Consumer

And lastly, let us look at the subject of accurate measurement from the standpoint of the person responsible for this entire outlay of effort and capital expenditure—the ultimate consumer. True, most consumers have little or no knowledge of the intent or working of the meter located at their homesite. Yet, the billing submitted with unrelenting month-end regularity is based on the accuracy of that instrument. The consumer must depend upon the integrity and know-how of measurement personnel employed by the distributor for fair and accurate metering of gas delivered to him. Any inaccuracy on the high side is costly—for his payment is based on the volume reflected by the meter. Thus, the consumer should be vitally interested in the accuracy of measurement.

It may be noted that operating practices often are indicative of company policy. Our question has to do with management attitude toward accuracy of gas measurement. It is impossible to see how any company that is paying or receiving pay for gas could afford to ignore the importance of accurate gas volumes. For *volume* multiplied by an accounting department constant (price per Mcf) yields the value of gas handled—*dollars in the till.* Notice the direct relationship between volume and value, any decrease in volume results in a decrease in dollars. No merchant will tolerate mishandling of his money in his cash register! It is difficult to conceive how a gas company (be it large or small) can do otherwise.

The reader may say: But what can be done to improve the situation, to focus management attention on accurate gas measurement? And further, how could management advance good measurement?

We offer no cure-all but pose the following points as a starter:

(1) Placement of qualified and dedicated personnel at the head of the measurement department.

(2) Assignment of adequate authority to assure installations and operations in conformance with good measurement practices and techniques.

(3) Adoption of an adequate measurement operating group responsible for gas measurement from facility design to completion of volume computations, including responsibility and authority over all phases of measurement operation.

(4) Commitment of necessary capital and personnel to ensure the development and proving of better instruments and techniques.

(5) And last, but of primary importance, recognition by management of the need for accurate measurement and assurance by management of cooperation and support.

Or, could it be that management and regulatory agencies are not interested? ■

COMMUNICATIONS • Continued from page 103

facility which could operate without commercial power.

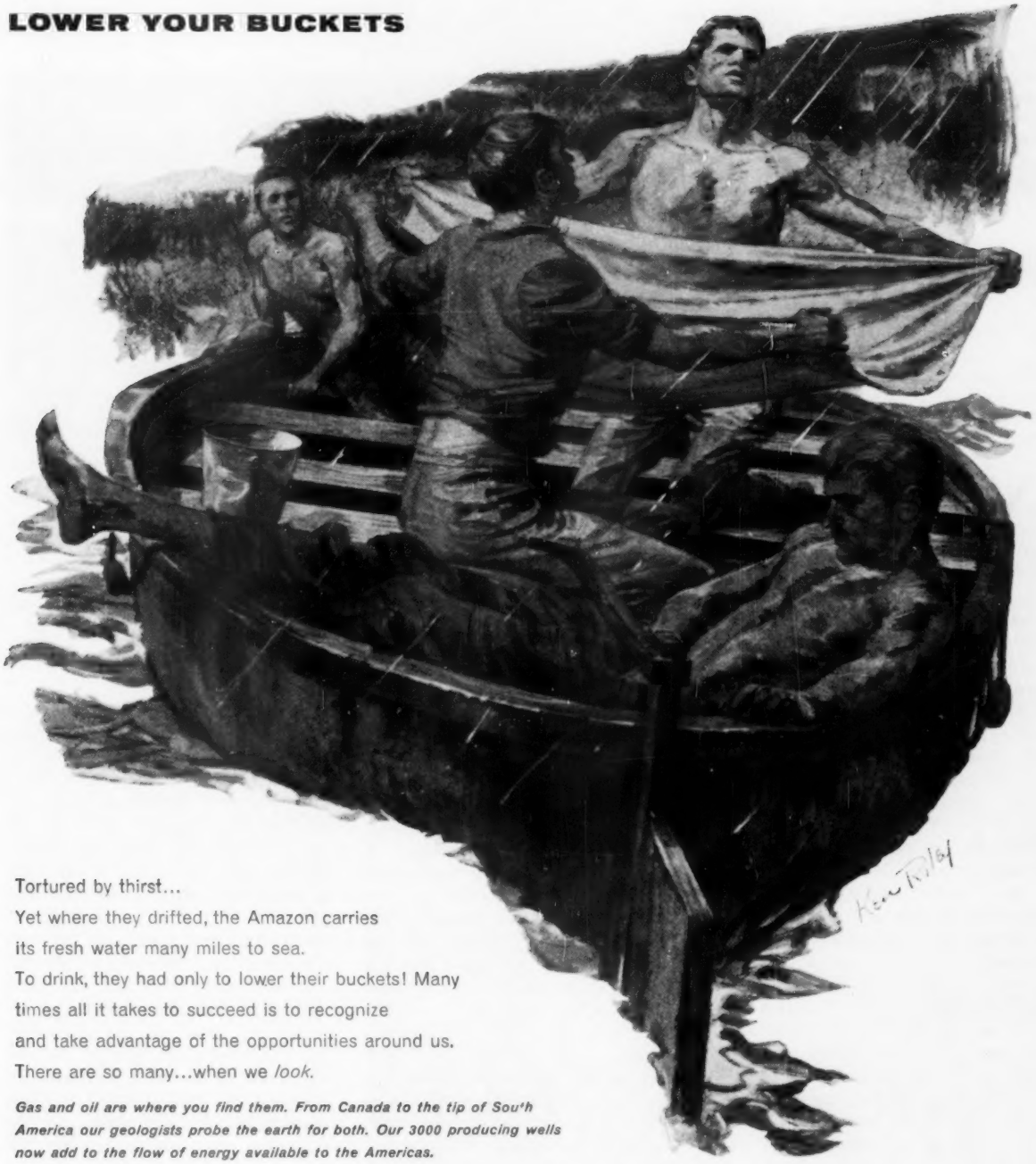
There has been some interest lately in the development of high-speed tele-control facilities which might operate in the vicinity of 1000 bits per second (or 1000 bands), which is quite a speed-up of existing installations which operate at possible 8 to 100 bands.

There are pros and cons as to the advisability of this type of high-speed control and data handling, but at least one company has taken the plunge and has such equipment on order. They feel that if you want to learn to swim, you've got to get in the water! The equipment is solid-state and operates on the principle that the control center interrogates in sequence each remote station and transmits to it instructions, and also receives a programmed list of information which is displayed by typewriter and possibly later will be input to a computer. The advantage is flexibility; many stations on one circuit; and speed of operation, which becomes important if many stations are to be read in sequence and investigated by a computer.

The disadvantages are that telephone grade communication circuits must be employed and such circuits must be of good quality.

The first installation of this type should be in the process of installation during the first part of 1962.

LOWER YOUR BUCKETS



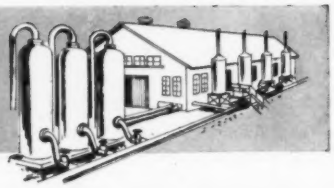
Tortured by thirst...
Yet where they drifted, the Amazon carries
its fresh water many miles to sea.
To drink, they had only to lower their buckets! Many
times all it takes to succeed is to recognize
and take advantage of the opportunities around us.
There are so many...when we *look*.

Gas and oil are where you find them. From Canada to the tip of South America our geologists probe the earth for both. Our 3000 producing wells now add to the flow of energy available to the Americas.

TENNESSEE GAS TRANSMISSION COMPANY

FROM NATURAL GAS AND OIL...HEAT, POWER, PETROCHEMICALS THAT MEAN EVER WIDER SERVICE TO MAN

HEADQUARTERS: Houston, Texas • DIVISION: Tennessee Gas Pipeline Company • SUBSIDIARIES: Midwestern Gas Transmission Company • East Tennessee Natural Gas Company • Tenneco Corporation • Tenneco Oil Company • Tenneco Chemical Company • Tennessee Life Insurance Company • AFFILIATE: Petro-Tex Chemical Corporation



Frozen earth stores LNG

Overall view of experimental frozen earth storage site. Black, insulated line from foreground to top of pit is flow line from above-ground storage tank; aluminum line to left is vent line to regulating valve and stack; structure beyond pit is "Carter Box," enclosing submerged pump; small roofed structure beyond pit houses compressor for activating vapor lift system.

NATURAL gas becomes a liquid at a temperature of —268 deg F. At atmospheric pressure it occupies a volume only 1/600th that of the gas at 60 deg F. Were it not for the problem of maintaining a low temperature necessary to keep the liquefied natural gas (LNG) in that state, storage of the liquid would offer many advantages over any type of storage as a gas. Embrittlement of metals at low temperatures, however, as witness the tragic failure of a LNG storage tank in Cleveland, Ohio, (in 1944) poses a serious handicap in any type of above-ground storage.

A new approach to LNG storage has been worked out and put into demonstrable operation by Conch Methane Services, Ltd., of London, England, and Constock Pritchard Corp. of Kansas City. Their method involves storing LNG in an earthen pit, sealed by an insulated aluminum cover, and retained in the pit only by the surrounding frozen earth.

To form the pit exhibited, on the Haymark Loading Terminal of Shell Oil Corp. a few miles down the Calcasieu river from Lake Charles, La., the site was first frozen by driving a circle of refrigerating pipes into the earth around the proposed pit. Frozen material was excavated with air-powered chisels of the type used for breaking pavement. The experimental pit, 20 ft in diameter and the same depth, with a hemispherical bottom, was maintained in frozen condition by continuing circulation of the refrigerant until the tank cover was put in place. Canvas and insulating materials shielded the ground around the tank during the digging operation. This reduced radiation and possible chance of walls slumping from solar heat.

With the tank cover in place, a 2-in. pipe, carrying on its lower end an inverted sprinkler similar to those used for lawn sprinkling, was lowered into the pit and circulation of LNG started. During the period of cooling the walls to —268 deg F., through evaporation of the LNG spray as it expanded, the sprinkler head was alternately raised and lowered. This produced uniform cooling of the earth and allowed progressive freezing outwardly without causing excessive heaving and possible fracture zones.

The pit cover is of 0.25-in. aluminum, welded to form a spherical segment with a 24-ft radius at the base. Since the pit is 20 ft in diameter, the roof, insulated with 1 ft of fibre glass, extends 12 ft beyond the rim of the pit. Some 4 ft of this dimension is taken up by the hermetical seal which joins roof and pit walls, and provides a gas-tight unit which can vent only through the regulating devices on the vent line extending through the roof and out a distance of several hundred feet from the storage area. The extended roof coverage, beyond the scope of the seal, protects the frozen earth from thawing and setting up serious heat losses. At the time the experimental run on the pit—something over two months—was concluded, the frozen section of earth had gradually widened until it had passed beyond the edge of the roof or cover. To provide protection when the freezing action had extended that far, canvas was laid over the ground, which had

By Elton Sterrett

been given a slope to provide adequate drainage away from the pit.

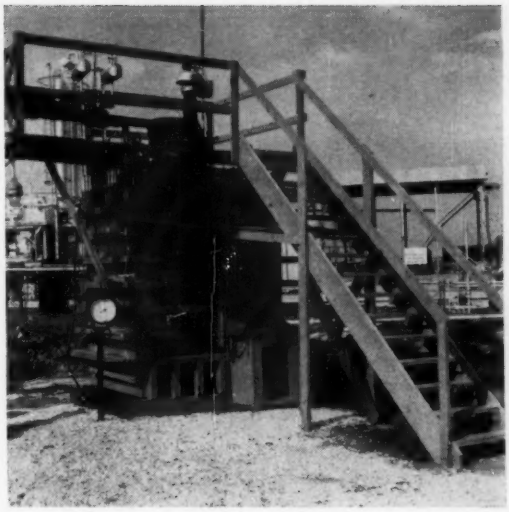
During the time the pit was in test, during which it was used as a check point for loading barges with LNG, no gas leaks were detected, with the pit operated under a pressure of 10 in. of water.

The soil in which the experimental pit was dug is typical of coastal Louisiana; sand, silt, clay lenses and organic material deposited by flood waters, with a water table only a matter of 2.5 ft below the surface. There was no flooding problem, of course, the water becoming ice and causing trouble only through the excessive heaving encountered during the excavating operation. The pit is bottomed on a clay stratum, shown by buried thermocouples to be frozen to a temperature of —100 deg F. for about 3 ft below the base of the hemisphere, and to 0 deg F. about 5 ft below the lowest point of the storage area. At the time these temperatures were determined—30 days after initiating operation of the pit—the ground temperature isotherms given extended about 5 and 8 ft, respectively, beyond the pit walls 2 ft below normal ground surface.

Boil-off losses from this pit averaged from 3.5 to 4 per cent, depending on barometric and other climatic conditions. Boil-off vapors were led through the vent pipe and discharged through a high stack to avoid hazardous concentration.

The LNG was flowed from an aboveground tank into the pit by gravity, the flow line terminating below the working surface of the liquid. Since the pit was below ground level, and consequently not so situated as to permit gravity outflow, a vapor-lift system was installed. For any pump to operate, liquid must be led to the suction side of the pump with a net positive suction head (NPSH). This may be defined as the gauge pressure at the suction valve minus the gauge vapor pressure exerted by the liquid.

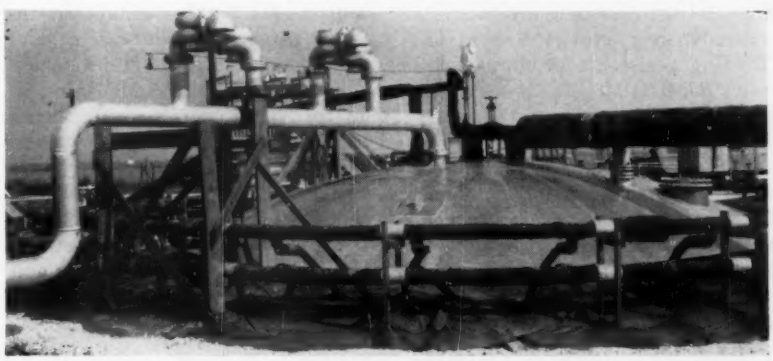
The "Methane Pioneer," a specially constructed tanker ferrying LNG across the Atlantic to England, utilized submerged pumps successfully for emptying its tanks. Since mounting a pump in the earthen pit would introduce foundation and sealing problems, a vapor lift or gas lift principle was adopted for emptying the pit. In this type of lift, the flow is set up by applying a vacuum at the receiving end of the pipe. The vapor and liquid thus obtained are separated and the liquid fed to a pump.



The "Carter Box" is a reinforced aluminum cell inside of which is mounted the pump for transferring LNG from pit to transport vehicle. Inasmuch as this was an experimental setup only, the "box" was mounted for convenience of operation and observation, not for appearance or simplified upkeep.

At the test site an insulated aluminum box or tank was mounted adjacent to the pit, with the pump mounted within this container. By means of a compressor, lifting power or vacuum is applied to the tank through the suction side of the compressor. LNG then flows out of the earthen pit and into the "Carter Box" (so termed because of the make of pump submerged therein) and is then pumped through the discharge line to the loading area. In a commercial operation the gas thus vaporized and drawn through the compressor would be heat-exchanged with the now sub-cooled liquid as the liquid is discharged from the pump and fed back into the system.

Comparative costs on working storage units of the same capacity range from $25 per barrel capacity for an above-ground metal tank to $4 to $6 a barrel for a mined limestone cavity, and down to $1.25 a barrel for a leached pit or "jug" in a salt bed or dome. Estimates on an earthen storage pit center around $1 a barrel, depending somewhat on the type of soil encountered. Pits up to 100 ft in diameter are feasible, with working depths dependent on soil conditions. ■



Close-up of pit cover showing a segment of refrigerating system used for preliminary freezing of site; feedline from left and multiple vents installed—but not needed—for removing large volumes of vapor during spraying period. Two insulating lines beyond vent line are to submerged pump, one for feed, the other for returning pumped LNG to pit during demonstration runs.

Complete valve actuator line announced

A COMPLETE line of cylinder-type valve operators compatible with the peculiar torque characteristics of plug, ball and other rotary valves has been announced by Ledeen Inc., El Monte, Calif. Covering a torque range from 200 to 4 million in.-lb, the line has 59 operator sizes for the smallest to the largest valve sizes.

Valve manufacturers have developed many mechanical design features to minimize turning resistance. However, a plug or ball valve is pressure unbalanced. It is subject to thrust loading equal to differential pressure acting on the effective area of the valve opening.

Lubrication is an important friction combatant, but is always the boundary type. Thus, coefficients of friction are always much greater than encountered in hydrostatics or hydrodynamic type lubrication. Turning resistance or torque of a valve depends largely on the coefficient of friction between the rotary plug and the valve body. Friction factor increases as film lubrication breaks down and boundary conditions become more severe. In general, maximum resistance to turning is experienced when a valve is: (1) standing unoperated for a period of time; (2) holding pressure while in closed position (max. unbalanced thrust) as in *Fig. 1;* (3) approaching the open position and is resisting the closing torque action caused by the mass flow of high velocity fluid entering and exiting the plug chamber, as in *Fig. 2.*

For these reasons, Ledeen research reveals maximum torque will develop—first in the initial zones of valve rotation as the plug moves from closed to open. Then again, as the plug approaches full-open under high velocity flow.

The manufacturer stresses two major features of his valve operators:

Double torque breakaway — Ledeen actuators deliver at breakaway two times their nominal rated torque. Torque at breakaway, and on to open, is shown in the lower curve of *Fig. 3.* The top curve is the typical reversible torque curve of Ledeen actuators. As indicated, breakaway torque is twice the nominal torque rating. All actuators are rated by nominal torque capacity.

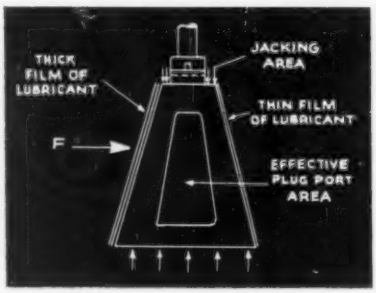


FIG. 1

Control flexibility — The operators are designed to accept a wide variety of fluid power and electrical controls for both on-off and modulating action. Ledeen basic control elements are coordinated into packaged systems and mounted directly on the valve operators. Elements include directional control valves, pneumatic and electric limit switches, sequence valves or switches, multiple limit switches, speed control valves, end of stroke venting valves, and modulating and power positioning controls. Various combinations can fit any required system.

Ledeen's four-cylinder or 'Quad" type unit is of symmetrical design, incorporates two separate fluid power circuits in a single actuator, and produces essentially "pure" torque with no unbalanced side loading on the valve stem. Even the largest units can be mounted on a valve in less than an hour. Alignment problems have been eliminated. Valve operation time can be varied from less than a second to more than 30 seconds. Stepped or variable speed circuits can also be provided.

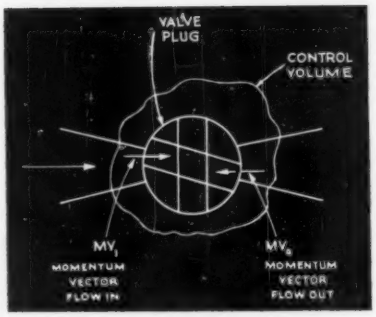


FIG. 2

Standard Ledeen actuators allow for a small amount of free motion before the driving roller contacts the lever drive surface. This allows cylinders to move initially under no load and reduces power loss due to initial friction. Most of their units incorporate detachable levers so the operator can be operated and control system checked without turning the plug valve.

Actuator models are available in three basic pneumatic and hydraulic pressure and fluid ranges—200 psig air, 1000 psig gas, and 2000 psig oil—the latter for use primarily in central hydraulic systems. ■

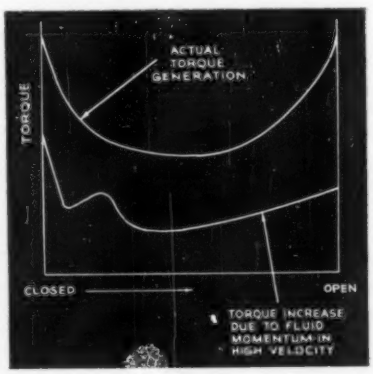
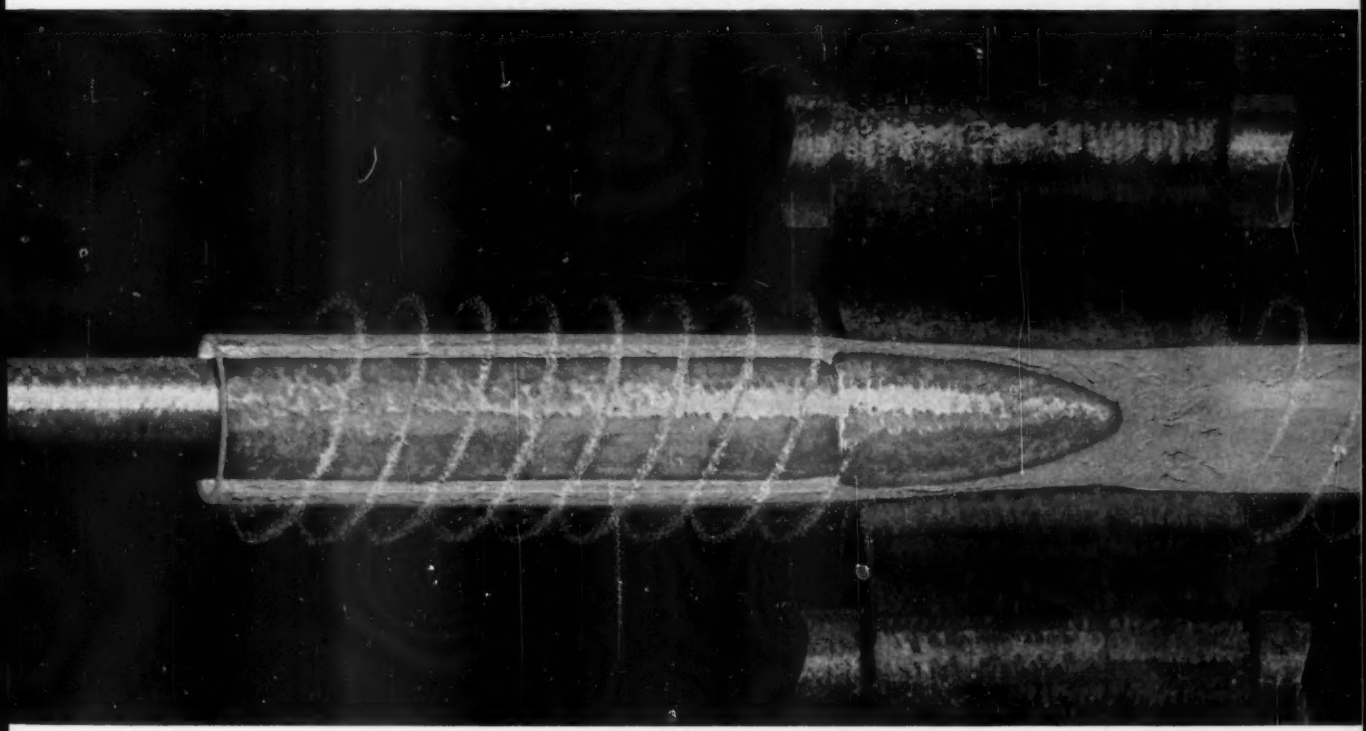


FIG. 3

What a tough way to come into the world!



The piercing operation is one of the first steps in creating seamless line pipe from a solid section of steel. After we set the hot steel billet in place, we ram it. Spin it. Push its insides out. And stretch it into a tube many times longer than the original piece of steel.

Consider this grueling way that USS National Seamless Line Pipe is made. Need we say more about its strength or dependability? You can see why Seamless is the safest pipe in the world.

USS and National are registered trademarks

Steel

This mark tells you a product is made of modern, dependable Steel.

USS

National Tube Division of United States Steel

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Pacific Coast Distributors
United States Steel Export Company New York

NACE meeting stresses pipeline corrosion

By Elton Sterrett

With 21 out of a scheduled 36 papers on its three-day program, National Association of Corrosion Engineers' South Central Region saluted the area as essentially a pipeline territory, since seven-twelfths of the program was devoted to topics directly or closely related to the oil and gas transportation industries.

Held in the Shamrock Hilton's Hall of Exhibits, with entry to the technical sessions only through the area devoted to exhibits, dual sessions were scheduled only for Tuesday afternoon and all day Wednesday, thus avoiding most of the disappointments suffered by those in attendance when a conflict of interest occurs through two simultaneously presented papers. More than 800 engineers attended, most of them from the area covered by NACE's South Central Region, but with Canada, Mexico, Switzerland and Venezuela lending international color.

At the symposium on aluminum, with Maurice O. Riordan, Rio Engineering Co., as chairman and W. H. Edwards, Superior Oil Co., as vice-chairman, a progress report was presented on the present status of aluminum pipe. Authors were M. E. Carlisle Jr., Ellis D. Verink Jr., and E. T. Wanderer, all from Aluminum Co. of America's New Kensington, Pa., operations. Cathodic protection was recommended for certain soils, although in instances cited pipe now in service for periods long enough to establish reliable data showed excellent results with no protection, with any pitting occurring being attenuated by the formation of a protective or inhibiting film after prolonged exposure. In one instance, where concrete anchors were to be attached over a coating of enamel and felt pads, the coating was omitted and the metal showed corrosion under the concrete weights.

Test sections of clad aluminum pipe, in service up to seven years, were found to be in excellent condition when examined. The grouping of lines for submarine use, bound together and with the anchor pipe to serve as a sacrificial anode, was described. In this type of installation the larger diameter anchor pipe was filled with water to submerge the cluster, after which the water was displaced with grout to provide sufficient weight to maintain the assembly in position. Substitution of the grout insured against the possibility of entrained air in the water fill creating possible points with sufficient bouyancy to raise the pipe from its bed. Various welding techniques for joining aluminum pipe were described and illustrated with diagrams and slides.

At the oil and gas production symposium, F. E. Blount and P. W. Bolmer, Socony Mobil Oil Co., described cathodic protection of surfaces of well casings. At this meeting J. A. Caldwell, Humble Oil & Refining Co., and E. J. Simmons, Sun Oil Co., presided as chairman and vice-chairman. Recognition of corrosion of external casing surfaces as a major expense in the oil and gas industries, and the increasing application of cathodic protection as a mitigation procedure, have brought to the fore problems which are not readily solved. The study reported by the authors was to establish the feasibility of protecting deep wells, and to validate the polarization curve method for fixing minimum protective current values. Both laboratory and field studies were used. The reference electrode for measuring casing to soil potential was located immediately below the casing shoe.

At the same session P. E. Pilkington, Continental Oil Co., discussed a method for simplification of caliper survey presentation. He discussed the shortcomings of the "pit depth rank chart" and the development of "pit distribution charts" to portray the distribution of pitting throughout tubing strings. The latter charts can also be used, he said, to illustrate other phenomena occurring on caliper surveys. He presented a set of nomographs for determining the safety factor of tubing string pits.

Joe P. Schultz, district engineer with Lone Star Gas Co., described the development of corrosion protection on what is termed the general division of his company, embracing all of its operations outside the city of Dallas and the Fort Worth districts. This division includes some 7000 miles of pipe and is, according to the author, subject to an annual bill of $2,107,000 for corrosion losses, including the charges for leak repairs, pipe re-

Transco seeks $49 million construction permit

Transcontinental Gas Pipe Line Corp. has filed an application with FPC covering $49 million in new facilities.

Transco president E. Clyde McGraw said the new facilities will enable an increase of 93.4 MMcfd in deliveries to 32 existing re-sale customers in nine states.

The largest part of the construction consists of 188 miles of 36-in. mainline paralleling Transco's existing system in Louisiana, Mississippi, Alabama, Georgia, the Carolinas, Virginia, Maryland, and Pennsylvania.

An additional 46,800 of compression hp will be added at 13 compressor stations in seven stations.

Other construction details include: 28 miles of 24- and 20-in. gathering laterals in Louisiana; additional hp at a station near Eunice, La.; a new intermediate compressor station on the McMullen gathering system in Goliad county, Texas; and metering and regulating facilities in Bucks county, Pa.

placement, and installation of cathodic protection. As a result of continued study, the company in 1960 adopted the policy of applying enamel, glass wrap and paper to all new distribution lines.

Schultz outlined the company's program of employee training, in which relatively few men are eventually engaged full time in corrosion prevention, but in which most of the other field employees have as a part of their duties such tasks as checking anodes—the company has standardized on magnesium anodes throughout. He cited his own case, in which some 5 per cent of his time is concerned with corrosion, the remainder being devoted to other phases of pipeline operation.

Schultz's paper represented the gas industry on the symposium on utilities, which had D. E. Simmons, Houston Lighting & Power Co., as chairman and K. D. Wahlquist, Southern Union Gas Co., as vice-chairman. The remainder of the session was devoted to communications and power topics.

The pipeline symposium, A. T. Surber, Trunkline Gas Co., chairman, and Paul D. Palmer, Columbia Gulf Transmission Co., vice-chairman, heard Donald F. Koenecke, Enjay Laboratories, discuss new resins, new techniques and new thoughts of corrosion resistant coatings. He presented results of laboratory studies which indicate that corrosion protection efficiency is not consistent with the demonstrative properties of presently available coating materials. Failure mechanism led to the belief that degradation occurs through contamination and weak points. The solution to such problems would appear to be better application and optimum utilization of equipment.

A panel report on reducing friction losses in pipelines dealt entirely with gas pipelines, and was presented by three authors. W. H. Jamison, Tennessee Gas Transmission Co., discussed laboratory studies of internal coating, followed by a paper by C. H. Klohn giving that company's field experience with internal coatings. The laboratory studies were set up to investigate protection of the inside of the pipe during protracted periods of storage, to mitigate corrosion and prevent impairment of the surface and subsequent raising of the friction factor. A coating of 1.5 to 2.0 mils was found adequate, being sufficient to fill the valleys in the pipe material and reduce friction. Vinyls did not show to as good advantage as epoxys in tests conducted in the laboratory. In all cases, the manufacturer's recommendations as to mixing of the ingredients should be closely followed to obtain maximum results. Tests were conducted on 20 gauge 3x5-in. panels and graded as to appearance, sag, and continuity of film. Abrasion, impact and "burn-back" tests also were run.

In Klohn's paper emphasis was laid on recording pressure, flowing temperature and flow rate on tests, which were conducted between stations, pressures being referred to absolute, and for barometric correction. A probe, inserted through valve stem with a special packing gland, was used to determine gas stream pressure and temperature. The same type of apparatus was used to inject ammonia samples and withdraw gas samples at the next downstream station to determine flow time. An indicating solution through which the gas sample was passed was used to determine arrival time of the ammoniated gas.

A. W. McAnneny, Trunkline Gas Co., presented the third section of the panel report, dealing with the internal sandblasting of pipelines in place. First a 4-in. line was tested, in a move to determine the possible increase in friction suppression obtainable by this method of improving interior surface conditions. Following determination of the gain thus obtained for the 4-in., results were plotted against the curve for the theoretical smooth-pipe condition.

Tests were then run on a 26-in. line after running 18 pigs through the test section. Some 23,000 lb of sand were then blown through the section, using natural gas instead of compressed air for the driving force. An over-all gain of 14 per cent in the transmission factor was attained. Further tests, using 15,000 lb of sand, determined the erosion at a bend on the order of one mil, with erosion in the straight pipe being so slight as to be undetermined. In the tests it was found that velocity at entering of 4500 ft per min. would give effective cleaning over 10 to 11 miles of line. Higher input velocities were obtained by a pulsating, instead of steady, flow of the gas, and sections could be extended through this method. Checking the line after three months of operation following the sandblasting showed a drop of 1 to 1.5 per cent from the transmission factor attained immediately after the cleaning.

R. S. Dalrymple, L. E. Pennington and D. V. Williams, all of Reynolds Metals Co., discussed design and application of aluminum pipelines, supplementing the paper earlier presented at the aluminum symposium. Among the advantages put forward by the authors, as a factor in pipeline design, was that the aluminum pipe could be extruded to any exact size desired, and, with the heavy end design, could greatly reduce the amount of

CIG launches area development program

Colorado Interstate Gas Co. has launched a long-range program to attract new industry to Colorado and Wyoming. Other objectives of the program are to encourage existing industry to expand and help communities in the two-state area solve industrial planning problems.

CIG president W. E. Mueller named D. F. McMahon to head the new program. McMahon, an industrial development expert, has been head of Interstate's industrial relations since 1953.

CIG-sponsored ads will appear in national publications and in some 40 Colorado newspapers.

McMahon said the approach to industrial growth for Colorado will center in part around development of a current and complete inventory of existing facilities within the state. CIG also plans to produce a "products and service" index and will make its own technically trained personnel available on temporary assignment to firms showing interest in Colorado and Wyoming.

The area development services eventually will be extended to New Mexico, Kansas, Oklahoma and Texas.

PERFORMANCE AND ACCEPTANCE

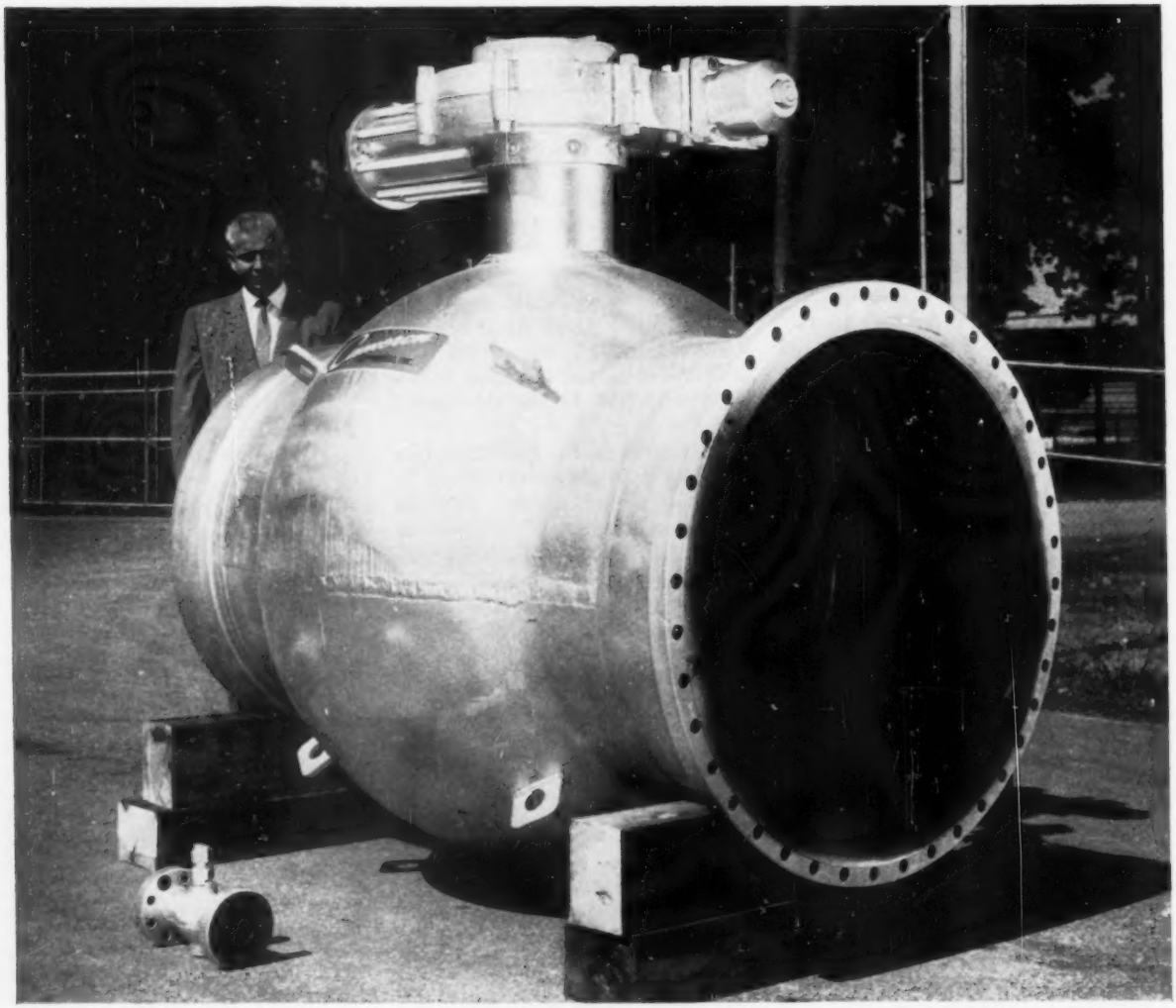
Repeat orders roll in for Cameron Ball Valves. Enthusiastic reports from test installations during the past three years show performance justifying every claim.

The reasons for this enthusiastic acceptance are plain – simplicity, with a minimum of parts – no bonnets or glands to leak – no lubrication for bearings or seal – easy to operate with Teflon bearings – tight shut-off indefinitely, with rotating seats – sealed for life, no maintenance.

Plan now to profit from the trouble-free operation and lack of maintenance expense of Cameron Ball Valves.

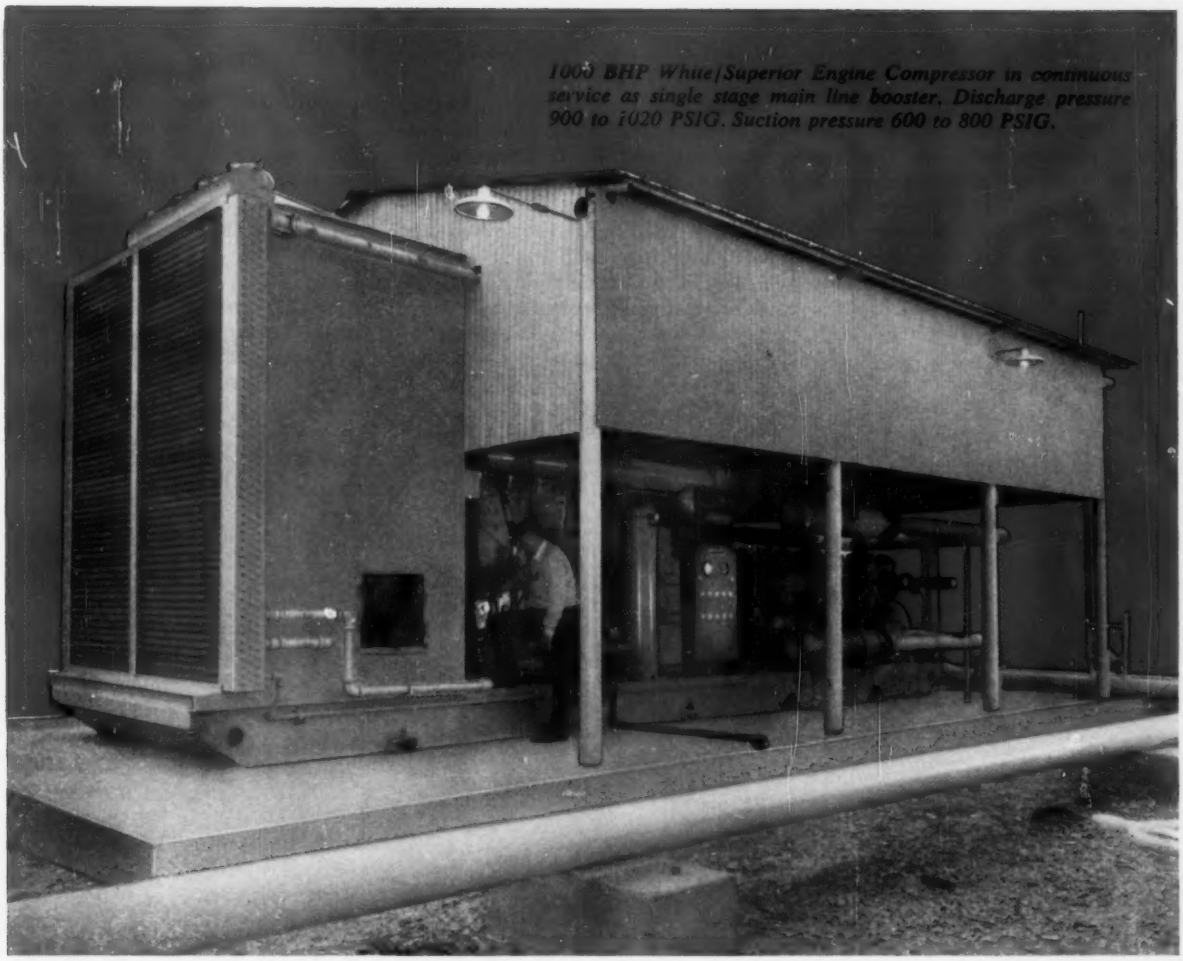
Cameron

CAMERON IRON WORKS, INC.
P. O. BOX 1212 HOUSTON, TEXAS



CAMERON BALL VALVES

Available in sizes 2″ through 42″



1000 BHP White/Superior Engine Compressor in continuous service as single stage main line booster. Discharge pressure 900 to 1020 PSIG. Suction pressure 600 to 800 PSIG.

TEXAS GIANT... *1000 BHP WHITE/SUPERIOR*

ENGINE-COMPRESSOR AT COASTAL STATES GAS PRODUCING COMPANY

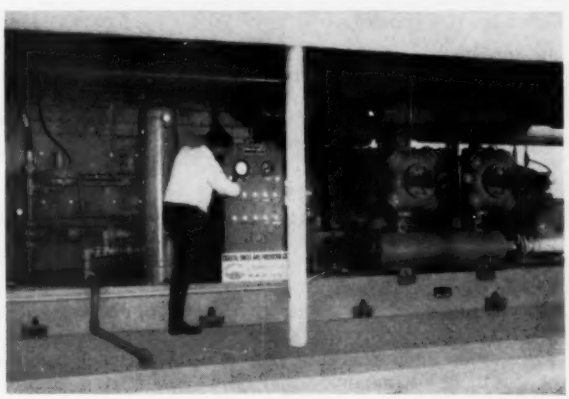
This White W-64 four-cylinder compressor, driven by a Superior 8GX-825 supercharged gas engine, develops 1000 BHP at 900 RPM. One of the highest HP units of its type in operation today, it has a capacity in excess of 50 MMSCFD. This *matched design* engine-compressor set is on duty at Coastal States Gas Producing Company's station, south of Houston, near Manvel, Texas.

White's medium speed, heavy duty, balanced opposed compressors—200 to 1000 BHP—are specifically engineered for direct drive combination with Superior natural gas engines or electric motors. Two, four and six-cylinder models offer cylinder sizes from 4000 PSI, 2⅝" dia. to 85 PSI, 22½" dia., providing 68 different cylinders. Custom sizes and designs are also available.

Compact packaged units can be engineered to your most exacting requirements for gas lifting, boosting, repressuring, peak shaving or underground storage applications. Get new Bulletin 124. White Diesel Engine Division, Springfield, Ohio.

White DIESEL | Superior ENGINES

White Diesel



metal required for a given throughput. They stated that, when designing a pipeline, the same formulae as for steel pipe were used, resulting in an ultimate pipe weight in aluminum ranging in savings from 25 to 35 per cent over the steel. Specimens from offshore lines in Lake Maracaibo were used to illustrate the slight corrosion damage suffered by aluminum pipe after prolonged exposure.

When aluminum pipe is laid bare, a homogeneous soil is a *must*, if corrosion is to be avoided. Sub-soil chemistry is important, if electrolytic corrosion is to be encountered. Anodes and tape-wrap were found effective protection. Any corrosion rate attenuates in three to five years, with pits of only 4 per cent of pipe wall in 20 years' exposure. Cathodic protection, in the range of —0.95 to —1.02 volts with a maximum limit of —1.04, was recommended. In the cluster lines laid in Lake Maracaibo, it is estimated that the sacrificial anode — the grout pipe—would afford protection to the other lines for a period of 50 years.

Before the cathodic protection symposium, with Marion E. Frank, Tennessee Gas Pipe Line Co., as chairman and R. J. Emerson, El Paso Natural Gas Co., as vice-chairman, B. M. Dearing, Texas Eastern Transmission Corp., described his company's use of parallel ground beds for the cathodic protection of bare pipelines. He stated that there are more than 92,000 ft of parallel-continuous coke breeze ground bed in use on the system, having been started in 1955. Favorable results have been noted on adjacent pipe.

The plan involves trenching between the parallel pipelines and laying strings of graphite anodes in coke breeze at the bottom of the trench, a foot below the lower tangent of the pipe. The anodes are connected to rectifiers on a buried header cable. These strings run from 1500 to 7000 ft, with various spacings of the anodes. Parallel ground beds were found to afford complete cathodic protection of the pipe adjacent to the bed; to cause very little foreign line interference; to cause low circuit resistance, hence lower power cost; good current distribution is attained; and results in high resistance soil are excellent. Some of the disadvantages listed by the author include expensive installation costs (as high as $4 per foot); protection is limited by the length of the bed; and high potentials are developed on adjacent sections of coated pipe.

At the galvanic anodes symposium, Walter Noser, Humble Pipe Line Co., and Stanley Kleinheksel, Magnolia Pipe Line Co., served as chairman and vice-chairman. Marshall Parker, Consultant, briefed the development of cathodic protection through the use of anodic materials, particularly magnesium. It was compared with protection obtained through the use of impressed current systems, and the range of its usefulness, as well as modification of this range through change in its properties considered.

T. J. Lennox, Jr., ASARCO, discussed zinc anodes, citing effects of anode current density and oil films on anodic performance. He also outlined the use of zinc as a reference anode in sea water. Successful applications were described, and limitations on the use of zinc anodes reviewed. ■

Pipelines bought 8 trillion cu ft in 1960

Interstate pipelines bought more than 8.1 trillion cu ft of natural gas from independent producers in 1960, according to FPC's report. Average cost was 15.6 cents/Mcf for a total of $1,265,381,342.

This compares with 1959 sales of 7.5 trillion cu ft at an average cost of 14.3 cents/Mcf. Purchases in 1958 were 6.8 trillion at an average cost of 13 cents. The average cost per thousand in 1957 was 12 cents.

The interstate companies themselves produced another 938.7 billion cu ft in 1960. They also purchased more than 10 billion cu ft of manufactured and L.P. gas.

Natural gas sold in 1960 came from 23 states plus Canada and Mexico. Of the total sales, 73.7 per cent were made by Texas and Louisiana producers (44.2 per cent and 29.5 per cent respectively). Only in three other states were sales as much as 5 per cent of the total—Kansas, 5.9 per cent; Oklahoma, 5.8; New Mexico, 5.5. Thus, more than 91 per cent of the purchased gas requirements were supplied by these five states.

The report also shows that more than 91 per cent of the total purchases were made from 282 producers, each making sales of 2 billion cu ft or more, either alone or as first named in combination with others.

FPC's new map issued

FPC's June 30, 1961 revision of its map, "Major Natural Gas Pipelines" is available from the Superintendent of Documents, U. S. GPO, Washington 25, D. C. Price: 15 cents.

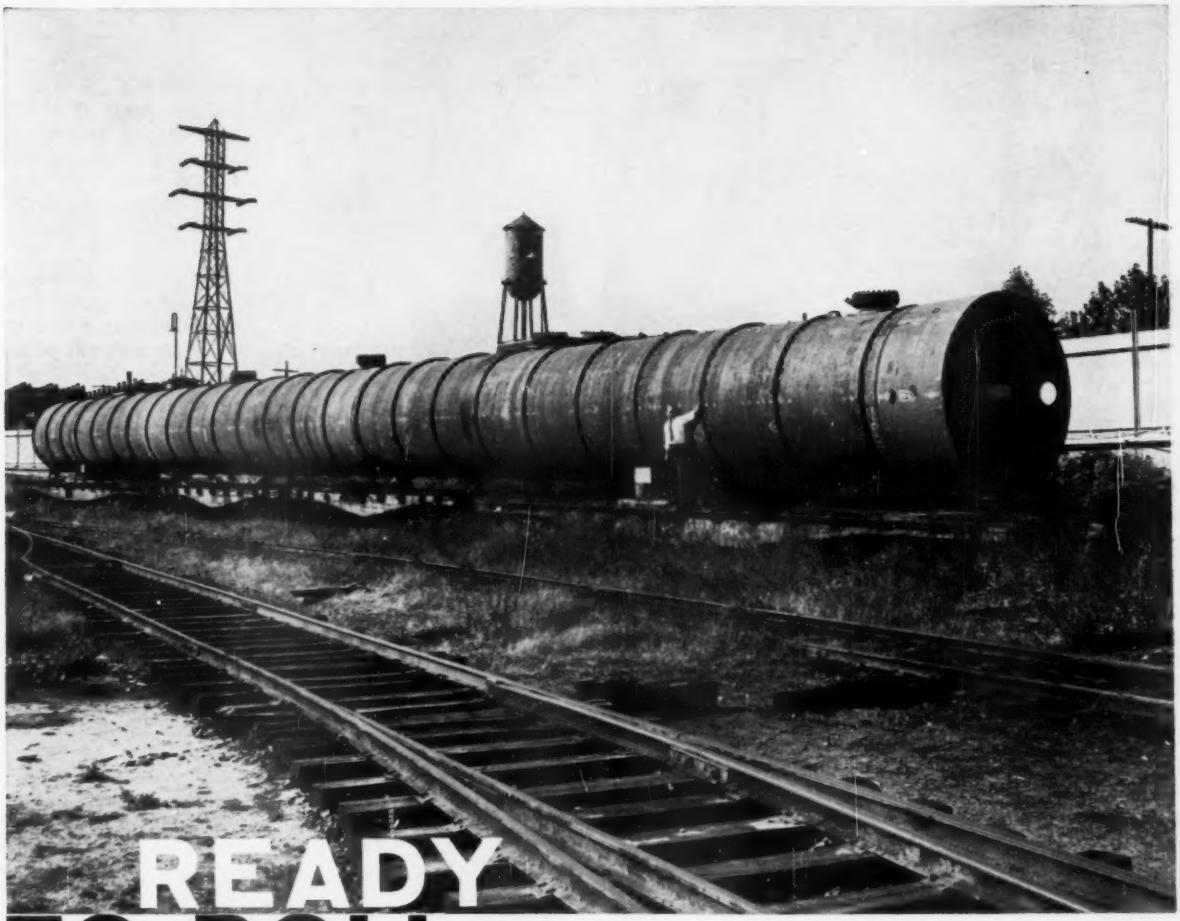
FPC to hear TGT—Tenneco transfer

Hearings get under way Dec. 5 on the transfer of natural gas producing properties from Tennessee Gas Transmission Co. its subsidiary, Tenneco Corp.

On Feb. 28, 1961, Tenneco applied to FPC for authority to begin natural gas sales to TGT from 20 fields in Texas and Louisiana. These producing properties were assigned to Tenneco by Tennessee on the same date.

In March, FPC asked Tenneco to explain all the considerations and financial and volumetric data involved. Tenneco replied that it entered into contracts with TGT which, in each instance, would provide for a price equal to the prevailing price that TGT is paying independent producers under other gas purchase contracts in each applicable pricing area.

FPC replied that the unsupported use of this method for setting gas contract prices between corporate affiliates has been held to be insufficient by the courts. Before it can determine the needs of public interest, the commission said the record must reflect whether the unit cost of gas to TGT and its customers will increase, decrease, or remain at present levels as a result of the proposed transfers.



READY TO ROLL . . .

Another big tower for industry

Building and delivering big items like the 165-foot-long fractionating tower pictured here is routine performance at Sun Ship. Two towers, each weighing 135 tons and identical with that shown above, were constructed for a petrochemical plant for processing petroleum gases. They were shipped on 9 flatcars. Railroad officials said it was one of the largest shipments ever moved by rail. Because of its length the shipment had to travel a circuitous rail route.

Whether it's a massive fractionating tower or intricate equipment, your requirements will be met with exacting precision and your product delivered on schedule by rail or water from our tidewater plant.

Sun Ship's modern fabricating and engineering services put these advantages at your fingertips. For full information, call or write our Sales Engineering Department.

Sun

SHIPBUILDING & DRY DOCK COMPANY

ON THE DELAWARE • SINCE 1916 • CHESTER, PA.

PUC jurisdiction report issued

FPC has published the 1960 edition of "State Commission Jurisdiction and Regulation of Electric and Gas Utilities." The last edition was published in 1955.

The new report presents results of a survey of commission jurisdiction and regulation of utilities in each of the 50 states, the District of Columbia, and the Commonwealth of Puerto Rico.

Thirteen tables show the powers of state commission to regulate utilities, other general information on commissions, and information on regulatory practices in the various jurisdictions, together with text material.

The new edition is sold by the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C. Price: 20 cents per copy.

Gas purifier unit developed

Weatherbuster Corp., Camden, Ark., has developed a small, low-temperature condensing unit which can remove foreign elements from natural gas at the well site.

Company president S. R. Wood said the unit can turn out natural gas so refined that it could be pumped directly into the gas lines for immediate use. Also, he said, the unit could be operated on the natural gas produced, making it practical for use where electrical power is not available.

United boosts deliveries to Pensacola users

FTC authorized United Gas Pipe Line Co., Shreveport, La., to build facilities to deliver an additional 49.8 MMcfd to its existing direct industrial and resale customers in the Pensacola, Fla. area.

United will build about 40 miles of 24-in. loops on its existing Mobile-Pensacola line at a cost of $3.8 million. This year's construction consists of about 21 miles of line, which will increase United's pipeline capacity by about 28.1 MMcfd to supply increased requirements during the 1961-62 winter. Of this additional capacity, some 18 MMcfd will go to United's firm industrial customers; 10.7 MMcfd will go to resale customers.

A. J. DiGiovanni
Mystic Valley

C. P. Martinello
Mystic Valley

Seth Roberson
NGO

Betty Cwiek
Robertshaw

Wilson Wood
Wauchusett

BETTY CWIEK has joined Robertshaw-Fulton's Robertshaw Thermostat division in Youngwood, Pa., as director of home economics. She succeeds MRS. SHIRLEY PEMBERTON, who resigned recently. Most recently, Miss Cwiek was a home economics consultant for Manufacturers Light & Heat Co. New assistant on the home economics staff is KARLYN VAUGHAN.

SETH ROBERSON has been named vice president and general manager of Natural Gas Odorizing Inc., Houston. He succeeds W. M. WILKINSON as operating head of NGO. Wilkinson resigned to become financial vice president of Kalvar Corp. Roberson has been with NGO for 13 years, most recently as vice president.

ROBERT J. MCCAFFERTY, formerly with Michigan Consolidated Gas Co., has joined Calcinator Corp., Bay City, Mich., as national sales manager.

WILLIAM ARWADY and RUSSELL A. WEBSTER, JR., have joined Caloric Corp. as sales representatives in the Baltimore, Md., and Buffalo, N. Y., areas, respectively.

JOSEPH N. BETZ has been named manager of AGA's Gold Star appliance program. Most recently Betz was general sales manager of the Pennsylvania Gas & Water Co., Wilkes-Barre, Pa.

CARL P. MARTINELLO has been named assistant production superintendent for the Mystic Valley Gas Co., Malden, Mass. New distribution engineer for Mystic Valley is ANTHONY J. DIGIOVANNI.

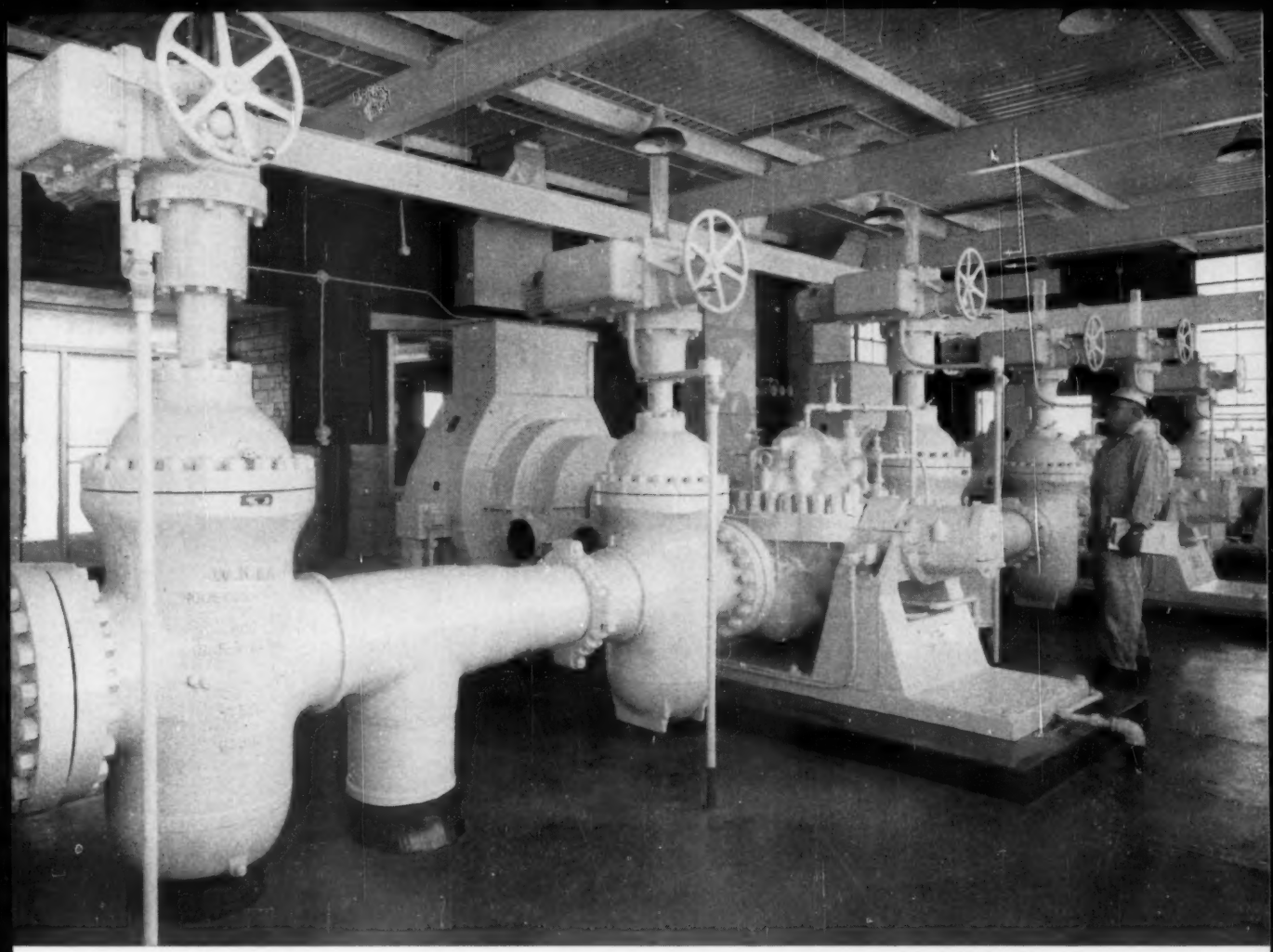
HARRY W. ZIETHEN, superintendent of the tax administration department of Peoples Gas Light & Coke Co., Chicago, is a newly elected assistant vice president.

HARRY LEE has been named assistant general superintendent of Ohio Fuel Gas Co.'s gas measurement department.

WILSON E. WOOD has been promoted from construction supervisor for the Mystic Valley Gas Co. in Malden, Mass., to general superintendent of the Wauchusett (Mass.) Gas Co.

THOMAS A. FEARNSIDE and DR. ARTHUR J. GOOD have been elected to the board of directors of Stone & Webster Engineering Corp., New York.

ROBERT D. HOSKIN has been promoted from plant and service foreman for Ohio Fuel Gas Co. at Norwalk to company manager at Willard. He succeeds HAROLD P. MILLER, who has transferred to Norwalk as division regulator man.



YOU CAN'T BUY GREATER RELIABILITY

W-K-M Saf-T-Seal Gate Valves

The W-K-M SAF-T-SEAL Gate Valve is specified by people who demand outstanding sealing and top reliability *plus* economy. That's why five SAF-T-SEAL valves were chosen for this fully automated, 250,000 barrel-a-day crude oil pumping station.

The SAF-T-SEAL is a non-lubricated pressure sealing gate valve — its floating steel seats with Teflon inserts give positive, total contact sealing *both upstream and down, in both open and closed position*. Its basic simplicity provides a degree of reliability greater than any other similar valve. Further, when working parts become worn, new valve performance may be quickly restored by installing new parts while the valve is on the line. Other features, such as automatic relief of excessive body pressure, the efficient enclosed packing gland, the effectiveness of the valves in double block and bleed service are explained in Catalog WS 1061. Write for your copy today.

W-K-M SAF-T-SEAL Gate Valves are available in sizes from 2 inches through 42 inches. Pressure ranges: ASA 150, ASA 300, ASA 600, ASA 900.

WHEN SO MUCH DEPENDS ON A VALVE . . . *Specify* **W-K-M**

W-K-M
DIVISION

ACF INDUSTRIES

P. O. BOX 2117 HOUSTON, TEXAS

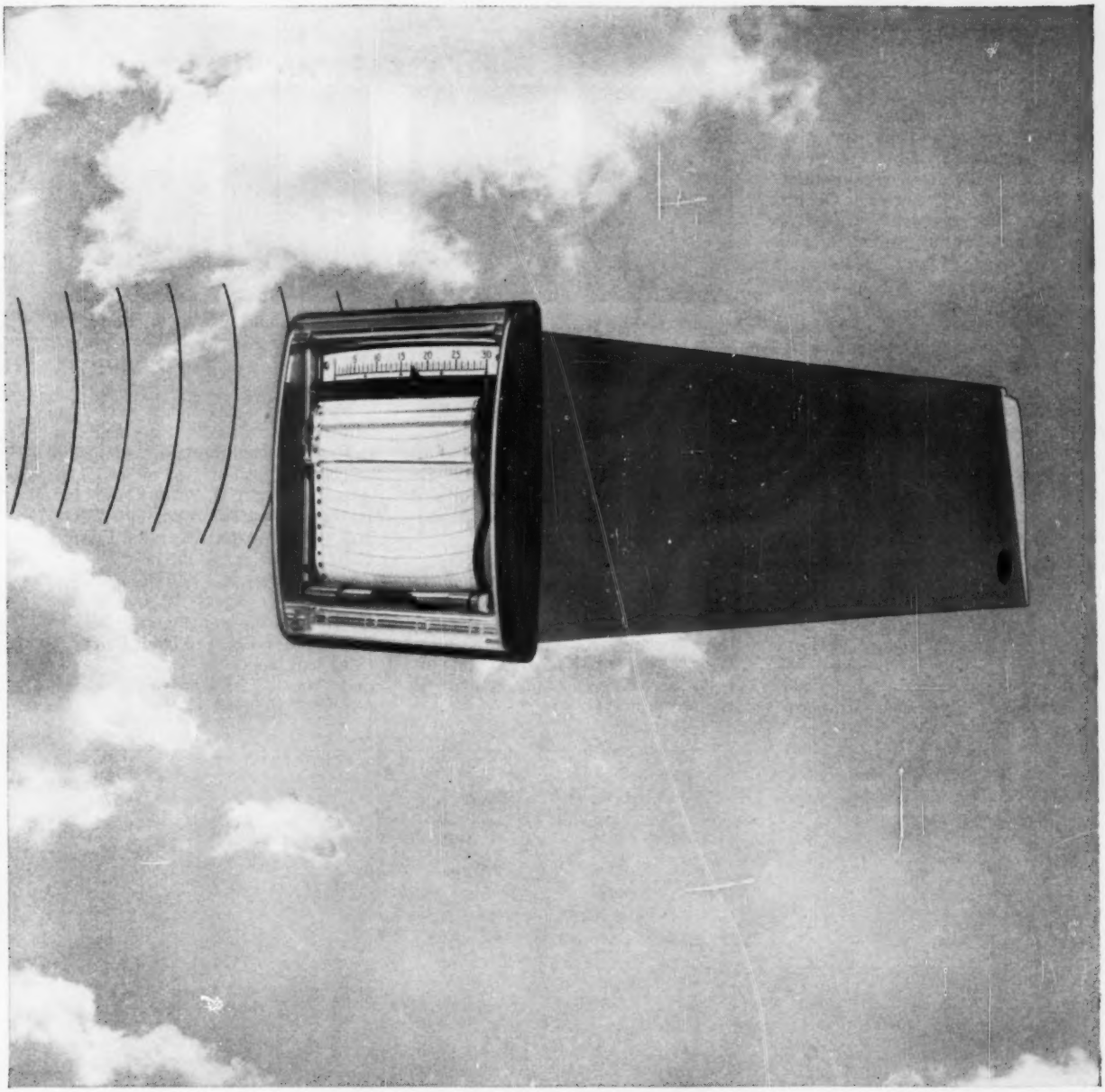
6119

new, 2-second cycle, all-electronic eliminates mercury switches...

A giant step forward in the science of telemetering measured variables — this is Foxboro's new telemetering system.

Completely electronic, the system abandons earlier mechanical means of producing a pulse-duration signal. Dry reed switches replace troublesome mercury switches . . . a photo-diode switch replaces the mechanical cam switch. There are no synchronization problems . . . no vacuum tubes . . . no periodic maintenance.

Standard impulse-duration cycle on the new Foxboro telemetering system is 2 seconds — 4 times as fast as any other standard system. The signal can be carried over any



telemetering system makes maintenance "plug-in simple"

transmission medium. Modular construction makes servicing easy as "plugging-in" a new component.

This is the telemetering system all industry has been asking for. For full details, write for Bulletin 17-12. Or better yet, ask your Foxboro Field Engineer for the complete story. The Foxboro Company, 3412 Norfolk Street, Foxboro, Mass.

FOXBORO

REG. U. S. PAT. OFF.

*Reg. U.S. Pat. Off.

California Chemical Co., Standard Oil Co. of California subsidiary, has announced four promotions within its top management group. T. G. HUGHES, formerly president of California Chemical's Oronite division and president of California Chemical International Inc., has the new post of vice president in charge of marketing for all California Chemical Operations in the U. S. and abroad. Succeeding Hughes as president of Oronite and California Chemical International is T. M. WELTON. H. B. POLLOCK, formerly Oronite sales manager of surface coatings and plastics chemicals, succeeds Welton as vice president and manager of marketing for Oronite. B. W. COLAIANNI, marketing specialist in surface coatings and plastics chemicals, was named to the new post of product manager for this group of products.

W. A. COLLINS, JR., has been named assistant director of Lone Star Gas Co.'s research and development department. Collins formerly was utilization coordinator.

T. G. Hughes
Oronite

T. M. Welton
Oronite

H. B. Pollock
Oronite

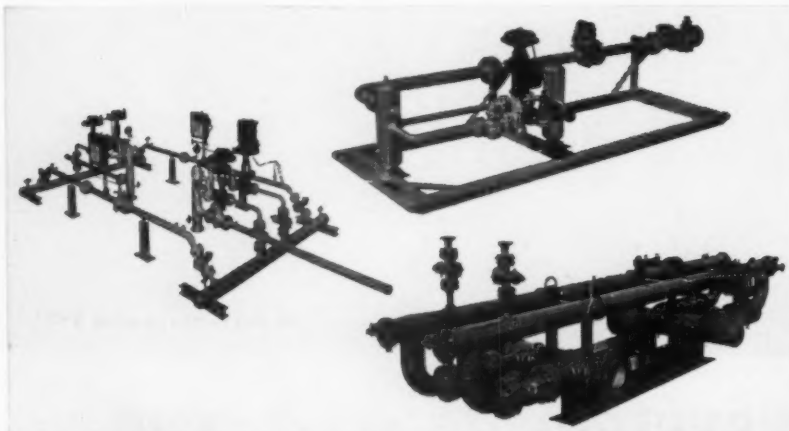
W. A. Collins Jr.
Lone Star

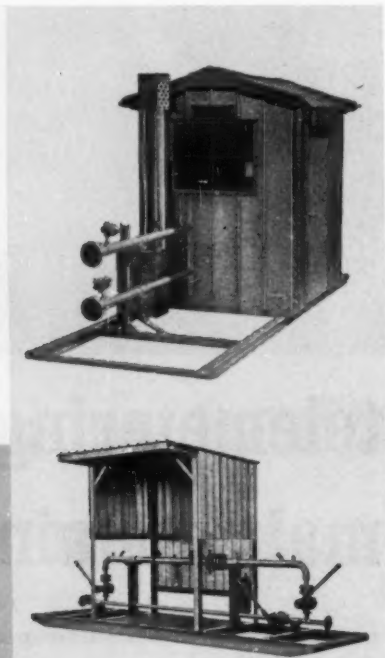
ARTHUR S. HALL has joined Michigan Consolidated Gas Co., Detroit, as district engineer of the company's eight northern districts. He was formerly division manager and engineer for Southeastern Michigan Gas Co., Port Huron.

A new organization, Webtrol Inc., has taken over sales representation for Fisher Governor Co. in Detroit and southern Michigan. Webtrol principals are PAUL WEBB, DOUGLASS WITTERS, and ROBERT L. WIDDOWS.

Four new sales offices have been established by U. S. Pipe & Foundry Co., Birmingham, Ala. The offices and their managers are: Atlanta, HARRY D. WADE; Memphis, RAY G. CARTER; Lansing, Mich., JOHN F. STADTLANDER; and Fresno, Calif., JOHN A. KUBIK.

ROBERT C. HENSLEY and VICTOR H. WEBB have joined Grove Valve & Regulator Co., Oakland, Calif., as sales engineers in Odessa, Texas, and Corpus Christi, Texas, respectively.





PACKAGED METER STATIONS

Start measuring gas immediately at the wellhead or at city gate sites with Daniel packaged, orifice meter stations. You save time in delivery, and save money in field labor costs with a complete Daniel package ready for tie-in to your line. Here are just a few examples of portable, skid-mounted units built by Daniel to customers' specifications. Each unit can be tested and X-rayed at the modern Daniel plant before shipping, and fitted with the meters of your choice. Want more facts? Write for Bulletin MS-1.

DANIEL ORIFICE FITTING COMPANY

9720 Katy Road
Houston 24, Texas

•

3352 Union Pacific Avenue
Los Angeles 23, Calif.

Spans creek in one day with pre-fabricated pipe arch

THIS self-supporting river crossing for a 20-inch gas pipeline was installed by Laclede Gas Co. in just one 12-hour working day. Midwest Piping pre-fabricated the entire 150-foot arch and its base headers in only two sections, each consisting of a converging pair of 16″ pipes.

The only installation of its type in the country, the arch is capable of carrying 200 million cubic feet of gas daily at 880 psi over the solid rock bed of Coldwater Creek north of St. Louis. For complete information on Midwest Piping's products and services, write for Bulletin 61A, PIPELINE FITTINGS.

6150

MIDWEST PIPING

A Division of Crane Co.
1450 South Second St., St. Louis 4, Mo.

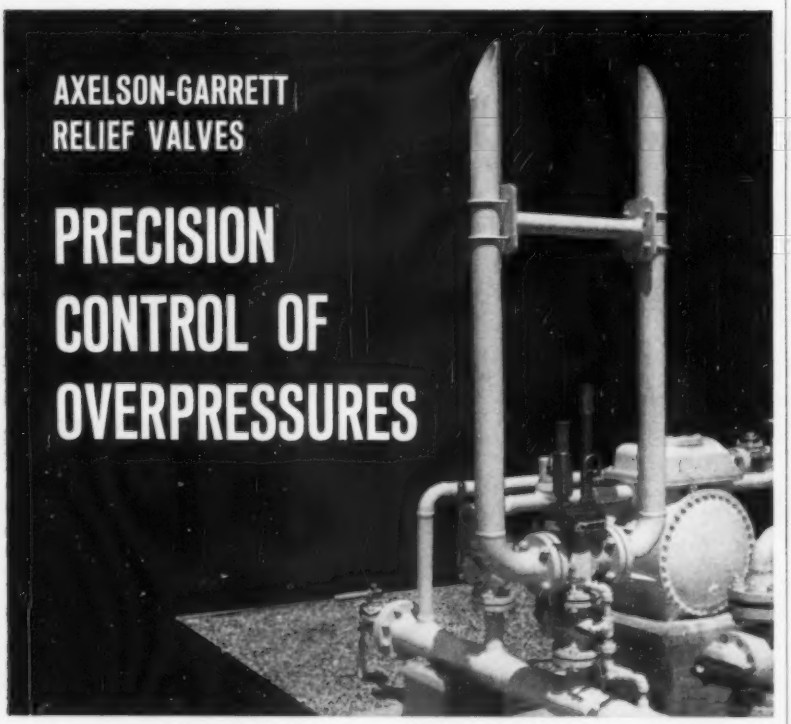
GAS Pipeline People

Frank Rivers
Northern

H. E. Midkiff
Stupp

W. J. McDade
Polyken

E. W. Pitt
Foxboro



Why take chances on overpressure damage to lines and vessels when you can have positive protection with Axelson-Garrett Pressure Relief Valves.? Dependable and automatic, they relieve, blow down and reseat within extremely close limits . . . often within 1% of system operating pressure . . . available in operating range of 25 to 6,000 p.s.i.

Changing conditions are no problem either, as the controls can be set externally with exactness and will maintain accuracy of set and reset pressure over unlimited cycles, with no pressure accumulation. There is a bonus in maintenance savings, too . . . Axelson-Garrett Relief Valves do not "chatter" or "simmer" . . . fast, positive opening eliminates wear on valves and seats.

Check with your Axelson-Garrett representative or write direct on how you can add these economical safety valves to your installation . . . ask for bulletin #RV.

Products Designed To Give OIL A Lift

usi Axelson-Garrett

DIVISION OF U. S. INDUSTRIES, INC. GENERAL OFFICES: LONGVIEW, TEXAS

FRANK RIVERS has joined Northern Natural Gas Co., Omaha, as director of the rate and tariff department. Before joining Northern, Rivers was manager of the rate department for Texas Gas Transmission Corp., Owensboro, Ky.

HOWARD E. MIDKIFF has been elected vice president for sales of Stupp Corp., Baton Rouge, La. For the past year, Midkiff has been sales manager.

ROBERT CIZIK has joined Cooper-Bessemer Corp., Mount Vernon, Ohio, as executive assistant, corporate development, working in the fields of acquisitions, subsidiary company investment, and foreign customer financing.

W. J. MCDADE, formerly with Northern Illinois Gas Co., has joined the Polyken Sales division of Kendall Co. as field sales representative for pipeline coatings, headquartering in Chicago.

VROMAN W. RILEY has joined Radio Corp. of America's microwave department. He has been assigned sales responsibility in 15 eastern states, headquartering in Camden, N. J.

EARLE W. PITT has been named western field sales manager of Foxboro Co. EARL M. KELLEY was named regional manager of the Cleveland territory and STEVE V. KERSTNER was named branch manager of the Los Angeles office, replacing Pitt.

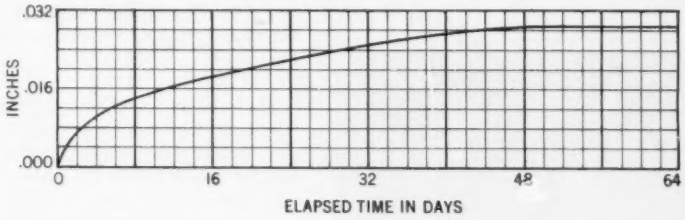
ARTHUR E. MCELROY has been named to the new post of assistant superintendent of the northwest transmission division of El Paso Natural Gas Co. JOHN M. VIEHWEG was named division engineer, succeeding McElroy. Both men headquarter in Salt Lake City.

NEWS FROM DOWN THE LINE!

Are all pipeline insulators as alike as two peas in a pod?

They're not alike, not in physical properties! When plastic insulators first became available for pipeline use, WmSON felt they were inferior to the steel and block types then available. We delayed our entry into the field until we could provide a plastic material to withstand field abuse and wear. We found that material in a high density polyethylene which could be injection molded to provide low cost insulators of the highest quality.

Our decision has proved sound. Breakage and excessive wear of glass fibre reinforced plastics, particularly in large sizes, has created a lack of confidence in plastics in general, but the M-2 Plastic THINsulator® has proved its stamina. Its high resistance to cold flow has been proved. Deflection test results: 1000 p.s.i. on each THINsulator runner for 64 days — total cumulative deflection only 0.029". Max. temp. during test, 105° F., min. temp., 75° F.



Its low coefficient of friction causes it to slide easily inside casing. The M-2 is completely resistant to impact fracture (4.0 ft. lbs./in. notched) and has successfully worked on 36" pipe, ½" wall, pulled in excess of 500 feet. We are convinced that it will perform as well or better than any other insulator on the market, including all known steel types. Other physical properties: *Dielectric strength* — (short time, ⅛" thickness) 500 volts per .001 inches (D149-55T); *Tensile strength* — 4400 p.s.i. at 20 in./min.; *Elongation* — 25% 20 in./min.; *Abrasion resistance* — Taber index 5.7.

The increased acceptance of the M-2 THINsulator has brought production to a level of real economy in injection molding. These cost savings are being reflected in new WmSON prices for 1961.

In planning '61 cased crossings, don't pay a premium for other insulators — use WmSON engineered M-2's and save!

T.D. Williamson, Inc.

P. O. BOX 40 • TULSA 2, OKLAHOMA

REPRESENTATIVES AROUND THE WORLD

Joe Kidd
Maloney

John Barry
Midwestern

John Strickler
Midwestern

R. E. Williams
Youngstown

JOE V. KIDD has been named assistant general sales manager and director of technical services for the F. H. Maloney Co., Houston. Also, MONTE D. LEATH has been named comptroller of the company, and J. L. GRIFFITH has joined the technical services department.

ROBERT PETH has been promoted to manager of engineering, mobile and portable communications products, by Motorola's Communications division. He is succeeded as chief engineer by JOHN F. MITCHELL. Motorola also announces the appointment of ROBERT L. BORCHARDT as national service manager.

JOHN S. TONETTI has been promoted to assistant manager, gas turbine sales, for Cooper-Bessemer Corp., Mount Vernon, Ohio.

JOHN BARRY and JOHN C. STRICKLER are new sales representatives for Midwestern Pipeline Products Co. and its companion companies, Midwestern Engine & Equipment Co. and Midwestern Manufacturing Co. Barry will headquarter in Odessa, Texas, Strickler in Monroe, La.

M. STUART LOOP has joined Solar Aircraft Co. as sales engineer in the company's Atlanta office. He will be responsible for sales activities for Solar's gas turbines and related turbomachinery in the Southeast.

ROBERT E. WILLIAMS has been named vice president-sales of Youngstown (Ohio) Sheet & Tube Co. He succeeds MYRON H. WATKINS who has resigned after 36 years with the company. Watkins had been vice president-sales since 1954 and a director of the company since April 1960. Williams previously was vice president-sales of National Tube division of United States Steel.

MILLS COX has retired as president of Transwestern Pipeline Co., Houston. He remains as a director of the company. Cox has spent the last four years with Transwestern.

Michigan Wisconsin Pipe Line Co. and American Louisiana Pipe Line Co. have elected two new vice presidents and promoted a third vice president. CHARLES J. MCINERNEY, secretary of Michigan Wisconsin, and W. ARTHUR BATTEN, secretary of American Louisiana, were elected vice presidents of their respective companies. ROBERT M. HOFFER, vice president and controller of both companies, was elected financial vice president of both.

DR. S. ROY MORRISON, senior staff scientist at Minneapolis-Honeywell's research center in Hopkins, Minn., has been promoted to assistant director of the center.

RONALD E. TOWNS, JR., is the new superintendent of Youngstown Sheet & Tube Co.'s electric weld tube mill at the Brier Hill plant in Youngstown.

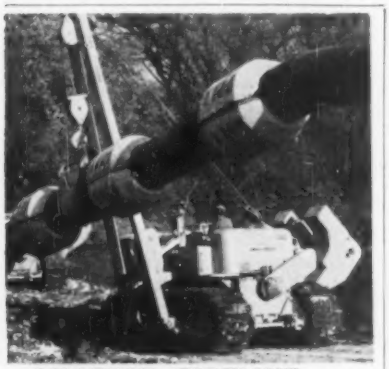
RON REITMEYER has been appointed senior systems analyst in the market analysis section of Bendix Computer division.

Two executives of Motorola's Communications division have been elected corporation vice presidents. HOMER L. MARRS, national sales director, Communications division, becomes vice president-sales. WILLIAM J. WEISZ, manager of mobile and portable communications products, becomes vice president, communications products.

DAN M. KRAUSSE, senior vice president of Cosden Petroleum Corp., has resigned to join Dresser Industries Inc., Dallas, as a vice president.

Deaths

HAROLD S. RAND, manager of employee relations and insurance for United Gas Improvement Co., Philadelphia, in Culpepper, Va. Rand had been with UGI since 1937, starting as an accountant. Later he served the Harrisburg Gas division as accounting manager.



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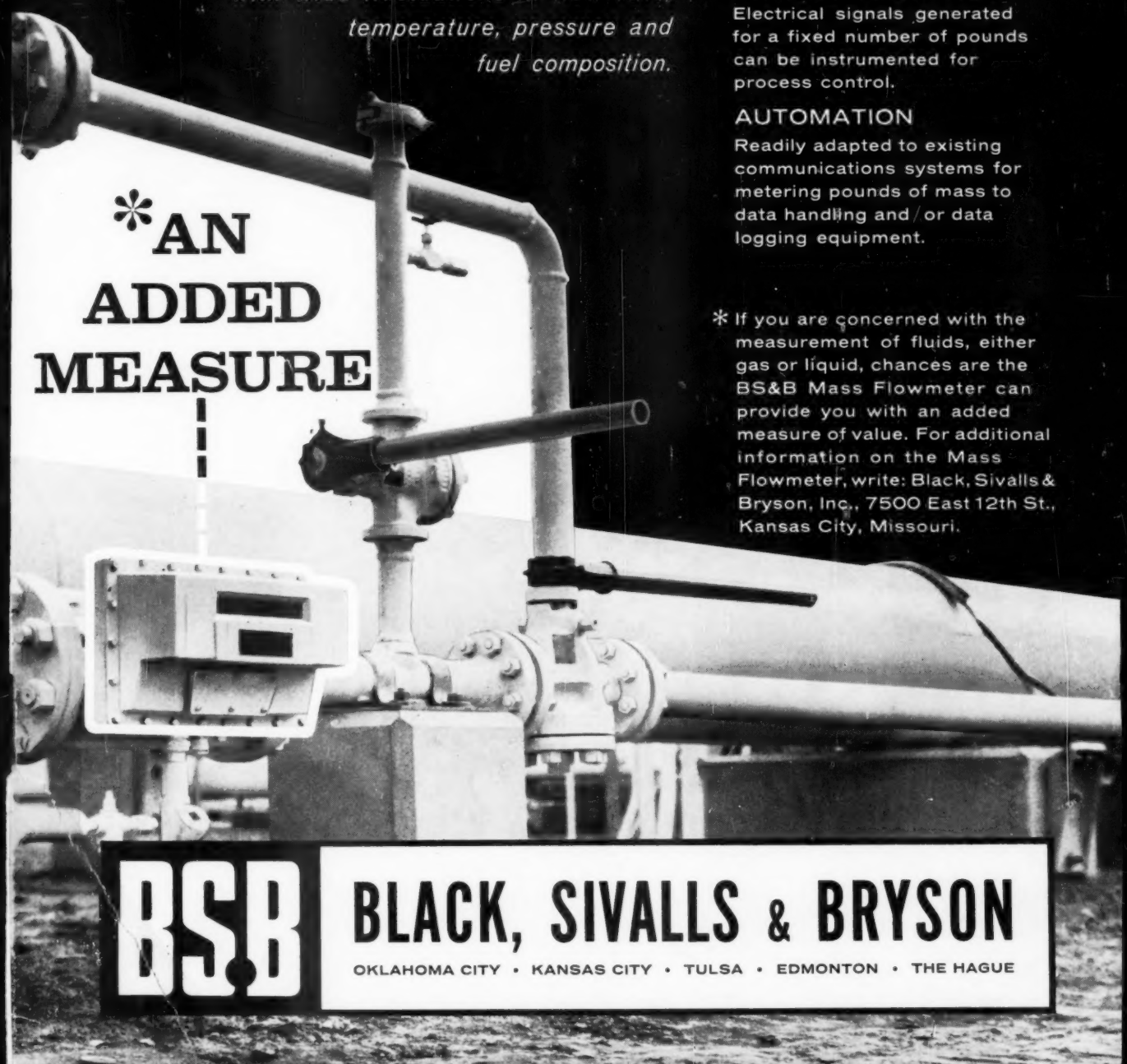

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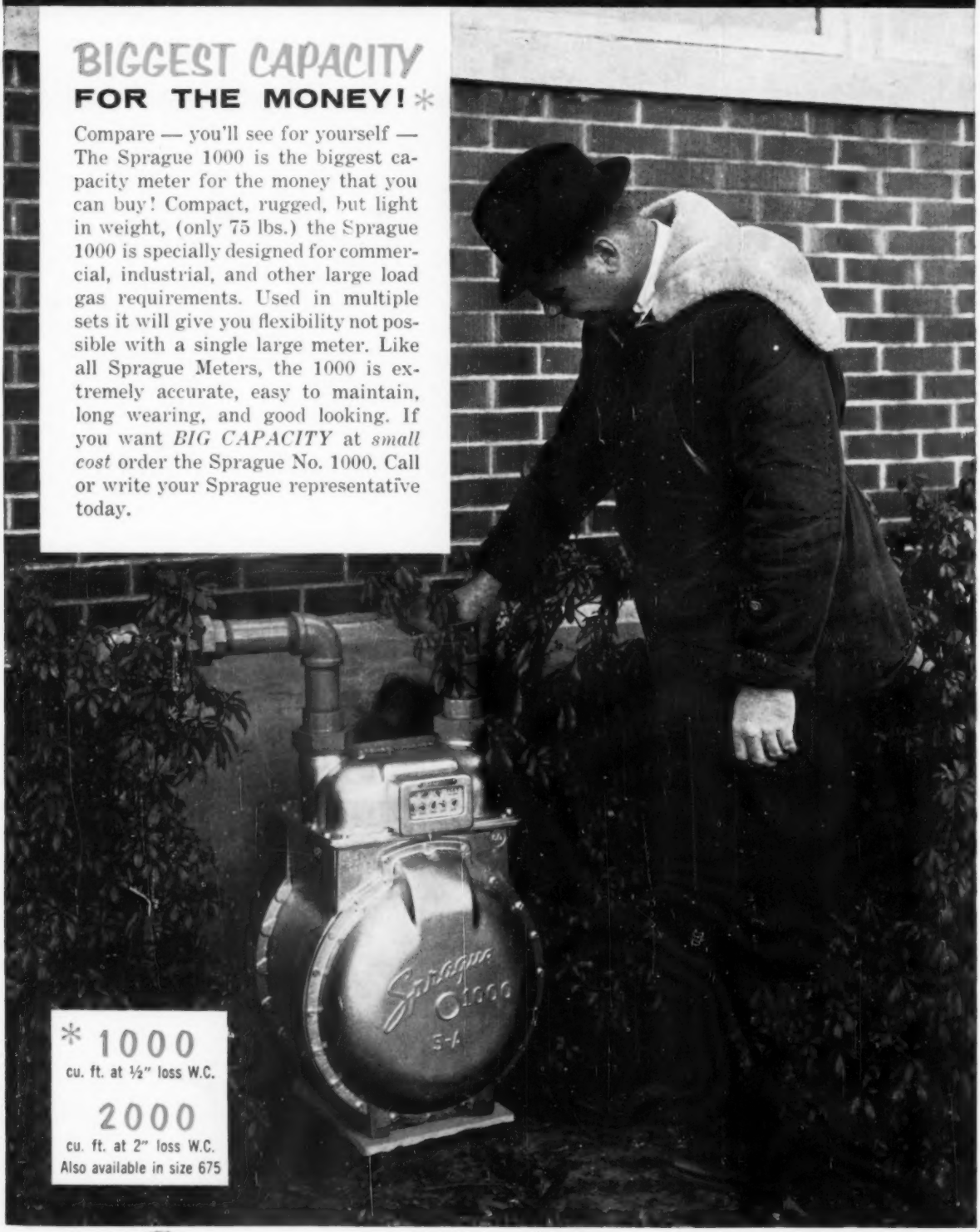

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